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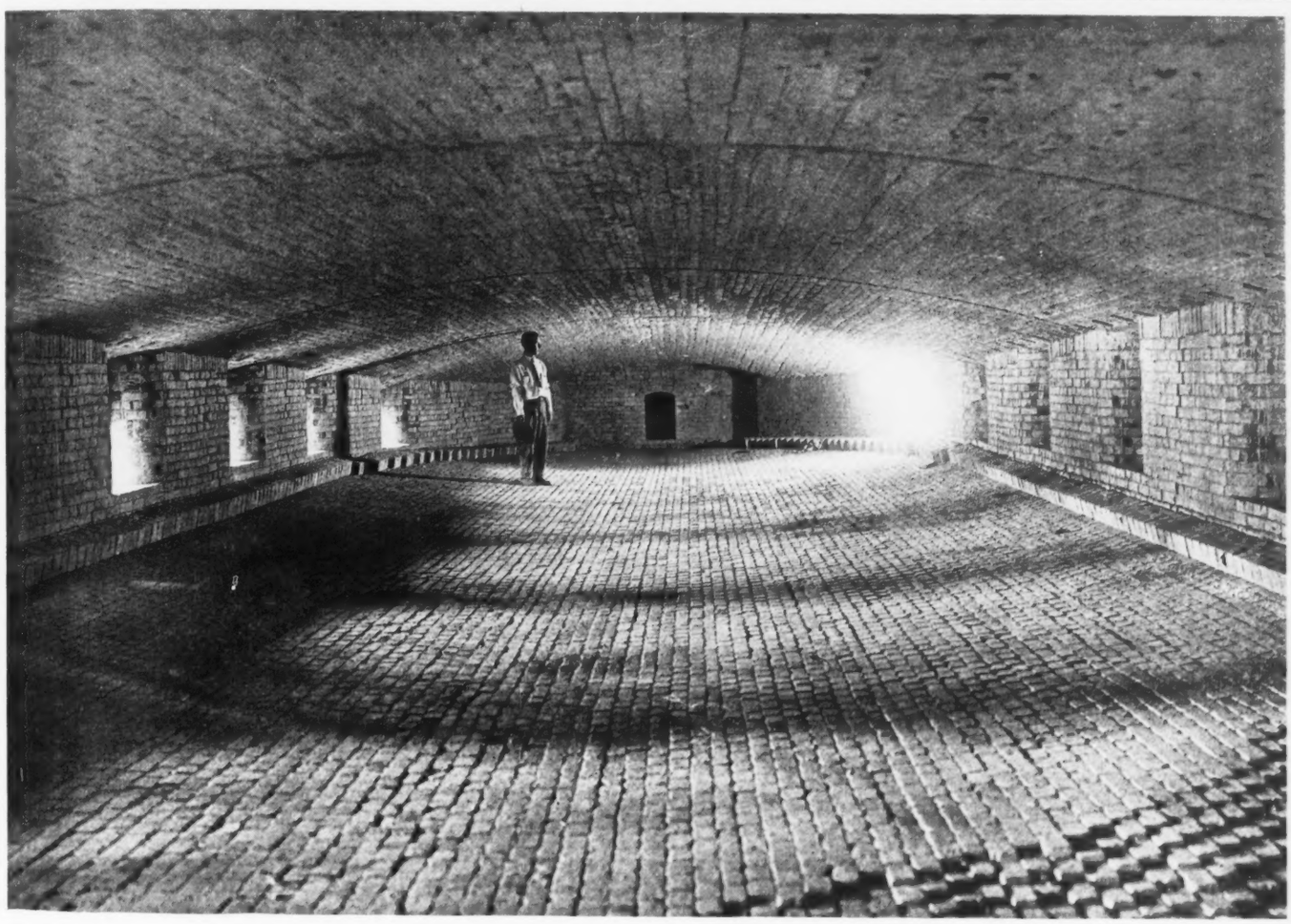

A REVERBERATORY INTERIOR

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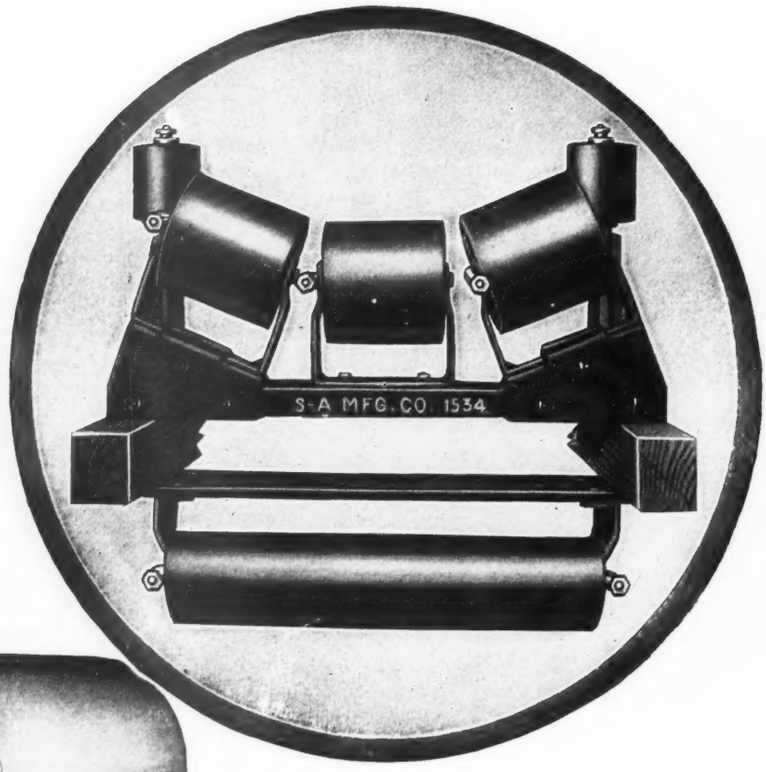

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ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

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Mining and the Department of Commerce

THE PROBLEM of the marketing of mine products is one which, as our readers know, *Mining Journal-Press* has specialized on, and one for which we have sought to develop data, knowledge, and principles. No mining enterprise can be successful unless the products can be marketed to advantage. Hence it falls to the lot of the mine corporation, to the president and directors and manager, to the mining engineer reporting upon a property, to study how the mine products shall be sold when they are won.

The Bureau of Mines has recognized the importance of this movement and has been devoting some time to co-operating with *Mining Journal-Press* in this study. Since, however, the Bureau of Mines, under the basic law which brought it into existence, is primarily a technological Bureau, the co-operation of the Bureau of Foreign and Domestic Commerce was sought by the Bureau of Mines in this work.

There is no question that the buying and selling of mine products comes into the field of the Department of Commerce. Nevertheless, the Department of Commerce has given no adequate thought hitherto to the commerce provided by the non-ferrous mining industries. This is surprising, considering the fact that the Secretary of Commerce is a mining engineer, who has built up the department and expanded its organization in all directions; or perhaps this delay may be explained by this very circumstance, for we have often pointed out the tendency of mining engineers, when engaged in economic investigations, to forage in other fields rather than in those near home. The sailor always hires a horse the minute he gets on land.

The Bureau of Foreign and Domestic Commerce has attacked the petroleum problem, and has an Iron and Steel Division; but hitherto has not been organized so that it ever clearly sensed the problems of the great non-ferrous mining industries and metal trades. This delay, to be fair, was not entirely due to myopia on the part of the department, but to the difficulty of obtaining the right man to investigate and organize. It has now obtained Mr. Guy C. Riddell, till recently of the Wah Chang Trading Corporation, the principal marketers of antimony, with headquarters in New York. Mr. Riddell's war work was as mineral adviser to the Tariff Commission in Washington, so that he is familiar with government methods as well as with metal trade problems; and his previous extended experience as a practicing engineer and metallurgist has made him familiar with the operation of the mining industries. He will head a newly created Mineral Division of the Bureau of Foreign and Domestic Commerce, and will endeavor to develop the service of the department in this respect so that it will be really useful to the mining industries. This work will be with the fullest co-operation with the Bureau of Mines; and, it goes without saying, of the *Mining Journal-Press*; and we believe of all those who are deeply interested in the welfare of mining.

Two Fatal Accidents

HUNDREDS of former students of the Michigan College of Mines were grieved to hear of the death in a railroad collision of Dr. F. W. McNair, for twenty-four years president of that institution. Accidental death always seems particularly hard to bear, for it usually comes to those who are in good health and who suffer through misplaced trust in their fellow man. An engineer, so it is reported, ran past an automatic block signal. Dr. McNair, we presume, had been unfortunate enough to be assigned to a berth at the end of the last Pullman.

The other day, David Cole was seriously injured in an automobile accident, and the driver of the car, Walter E. Soast, lost his life. Possibly that excellent rule "Do not try to pass another car on a grade or on a curve" was being violated by somebody.

Two observations might be made: Mining men may be safer underground, where they are thoroughly at home and understand what perils may be present, than they are on the surface. And where others have put their lives in our hands we must use every effort to be worthy of their trust.

Secretary Work and the Alaska Railroad

A NEWSPAPER DISPATCH from Anchorage, Alaska, records that Lee H. Landis, the manager of the Alaska Railroad (who, as we recorded editorially in the issue of April 19, had been installed in this job by Secretary Work) had dismissed the superintendent, dispatchers, and resident physician of the road, because of their criticism of his (the manager's) administration. All these officials were reinstated by Secretary Work after his office was bombarded with telegrams from Alaska protesting against the conduct of the manager. The newspaper dispatches further state that United States Secret Service men have been investigating Landis' management of the railroad, at the request of Secretary Work.

This news comes to us as no surprise. We have had private information from Anchorage that the railroad manager whom Secretary Work sent up to take charge was a grotesque misfit; and we have been informed of conditions that would gladden the heart of a Democratic scandal-smelling committee, but which are discouraging to the tax-paying citizen.

If Secretary Work's Secret Service men find out that his manager, Lee H. Landis, is incompetent, the blame for the incompetency and the mismanagement of government enterprises rests upon Secretary Work himself. We endeavored to estimate the fitness of Secretary Work in our editorial of April 19, and our estimate was distinctly unfavorable. Since writing it, we have had some letters defending him, the most comprehensive of which we published in our issue of July 12. The information which we have thus received from these letters has not changed our appraisal of the

Secretary's fitness for the position of Secretary of the Interior. We still see him as the last of the purely political, essentially incompetent Cabinet members whom the Republican Administration unfortunately rewarded for political services by giving them positions where they were an affront to honest and intelligent Americanism.

If Secretary Work has many friends, as our correspondent avers, we esteem that no argument. Ex-Attorney-General Daugherty had very many friends, among whom he is still, from all accounts, a deuce of a fellow: but that does not alter the fact that his appointment and his administration and his followers built up a scandal that will pass into history. Of the gang represented by Fall and Daugherty, who were appointed not for fitness but for some other and not tenable reason, Secretary Work alone remains. If the Democratic investigators had investigated the Alaska Railway administration, it is likely that he could not have survived the publicity. We still regard him as a governmental incubus and a net liability. How much his incompetence is costing the country in the matter of the Alaska Railway alone may never be given to the public, but the people of Alaska have a fair idea of it, and regard the whole situation as demoralizing in the extreme.

624 Per Cent Notay

THERE ARE ROCKS AND ROCKS in the road to fortune—some to trip over, others on which to get a firmer footing. Sound investments are among the latter. The stumbling blocks include wildcat ventures, unwise speculations, get-rich-quick schemes, and those responsible for them. Ponzi and his promises of fabulous returns are known to all. Ponzi is in jail. Others follow in his footsteps to lead their fellow men astray. Among them are certain individuals who call themselves "Harmon Beggs" and "Bert Eliot," and who have been sending their flamboyant literature into the United States from the safe distance of Mexico City. Comparison of their literature gives ground for suspicion that Beggs and Eliot are either one and the same person or that they are working for the same employer.

Now comes "Jas. R. Notay, M.I.M.E., A.B.," who offers 52 per cent monthly, with the assertion of 420 per cent paid in the last eight months. According to his circular, his next $100,000 dividend is due on July 20, to be paid in cash. As with the others, the profits are based on mining properties acquired since the revolution. "Profits cannot be used to develop properties or to purchase new properties. All profits are to be paid in the form of a cash dividend on the twentieth day of each month." It is promised that the August dividend will be larger than any, and that the September dividend will not be less than 80 per cent. Mr. Notay's headquarters are stated to be in Guadalajara, Jalisco, Box No. 10 *bis*. Those who are wise will consign all such literature to the scrap basket and advise others to do the same. It is not worth a moment's consideration.

Just as the bootlegger runs his merchandise across the border in defiance of our laws, so these swindlers ply their rotten trade. But the Mexican Government, either state or federal, could stop them if it wished, and with greater ease than in dealing with illegal liquor traffic. Or will it take months of time and an international convention?

The Microscope and the Decadence of Geology

NEW TOOLS—mechanical inventions—widen the possible scope of the individual's effort. Whether the final results are plus or minus depends on the ability of the individual to use his new tool wisely and intelligently. The invention of the firearm, of high explosives, gave humanity marvelous tools, whose use has hastened the destruction of civilization on the one hand as powerfully as it has helped to construct it on the other.

It was a great invention when the polarizing microscope was made, for it enabled geologists to pry into the microscopic secrets of the rocks' composition and structure. The invention was seized on avidly; it has added a great stock of data to our existing knowledge of rocks. Nevertheless, it is probably not a coincidence that the beginning of reliance on the microscope was contemporaneous with the beginning of a period of decadence in geology. The great master minds of geology wrought and thought with a magnificently broad perspective. Hugh Miller, Lyell, and Geikie, in Great Britain; Dana, Leconte, Powell, Dutton, and King in the United States, among many others, were not diverted in their interpretation of geological laws by the near-sighted contemplation of infinite detail. The laws that they proposed, right or wrong, have remained the accepted principles of a race of successors who, given the use of fine tools like the microscope, have tended to subside from geological philosophers to geological craftsmen. It became the fashion to record dreary lists of petrographical detail without connection and without significance, and to label that geology. It became the fashion to neglect field evidence, to overlook plain field relations, and depend upon the tale of the microscope. If one vein cuts another the evidence is often held commonplace and without clear significance; but the "paragenesis" revealed by the microscope (often misinterpreted and exaggerated)—that is real, scientific geology!

A second retarding wave swept over mining geology when the refinement of microscopic practice which consists in examining metallic minerals by reflected light was perfected. The up-to-date geologist visited mining camps, ignoring large-scale relations, collecting his specimens, and deferring impressions and conclusions till he should be alone with his microscope. If chalcopyrite cuts blende on a magnificent scale—that is often not sufficiently scientific evidence, because it may be seen with the naked eye. The craftsman will consider far more highly the evidence, under the illumination of his microscope, that chalcopyrite has a habit which indicates greater age, for the blende crystals are "moulded" on the chalcopyrite crystals. Previous work done without the microscope, all conclusions based on phenomena visible to the naked eye, whether or not coinciding with the up-to-date craftsman's conclusions, are underrated as essentially unscientific.

It is a fact that geological science is in the doldrums: that we have developed a numerous set of geological mechanics, who use the tools devised and the principles laid down by the great thinkers who worked before the microscopic period. These artisans understand the accepted dogma and the rules: they know such elements as unconformity, contact-metamorphism (according to their lights), faulting, replacement, secondary enrichment, the elementary use of the microscope, Chemistry A and Physics A; and they get by with this equipment. But horse sense has been softened by education; and

they are too well trained to look squarely at naked Nature.

President Lowell of Harvard, a detached onlooker and close observer of cultural and scientific advance, remarked recently that for many years geology had taken no step forward; when it did it would be time for universities to recognize its increased importance.

An Underground Roasting Furnace

THE PROSPERITY of a certain class of clothing merchants is popularly supposed to be in direct proportion to the number of times the stock is ravaged by fire. Not only can insurance be collected, but an excuse is given, whether or not one be needed, for a "fire sale," some of the stock being "slightly damaged by smoke and water." Mine fires are usually not so advantageous, but J. W. Bennie seems also to have discovered possibilities of putting the fire demon to work, even in a mine, for he has applied the torch to the copper sulphide orebody owned by the Shannon Copper Co. at Gleeson, Ariz. That ore of high sulphur content will burn underground is a well-known fact: the United Verde mine, at Jerome, has been on fire since 1897 despite all efforts to put it out, and the Minnie Healy mine, at Butte, has been on fire since 1906. But to make such fires serve a useful purpose, is, we believe, new.

The ore at Gleeson, containing 2 or 3 per cent copper and 25 per cent sulphur, is too low grade to warrant mining and smelting in the usual way. Also, it is not sufficiently oxidized to be successfully leached in place, as is done by the Ohio Copper Co. in Bingham Canyon. So it will be allowed to burn for a year or two, the shaft serving as a flue. It is planned to oxidize the ore above the 400 level by this method, that part of the mine being subsequently flooded with water for leaching the copper.

The method is cheap, but is slow and relatively inefficient. Its slowness must be considered an advantage just now, for, with the present state of the market, the slower the processes used for recovering copper, the better for the industry.

International Standards of Quality and Quantity

SECRETARY HOOVER recently made the statement that, "It may well be set forth, as a truism, that it is impossible to maintain proper standards of ethical conduct throughout business and industry without a proper background of recognized physical standards of quality and quantity. Much of the misunderstanding and ill feeling arising in the course of transactions between producers and consumers can be eliminated by the introduction of standards agreed upon as the basis for the interchange of commodities. What is true of transactions between individuals within a single country is true in even a larger measure when commodities produced in the country are delivered for consumption in another country. In order that international good will may be maintained and the interests of the individual and the public safeguarded, it is necessary to establish standards of quality and quantity in such commodities as enter into international trade. It is for the purpose of drawing into closer relationship the countries comprising the Pan-American Union that plans are now being laid for establishing international American standards."

This is a sound if somewhat lengthy and ponderous statement to the effect that we should get together with the South American countries on the metric system; and, since the South American countries already have the metric system in use, it boils down to the recommendation that the United States join in on the metric system as an international standard. The Bureau of Standards, which is under Secretary Hoover, has traditionally favored the metric system.

The World Metric Standardization Council has been much heartened by Mr. Hoover's statement, as given above, and has written him a letter asking him to take the leadership in introducing metric standardization. But that, we guess, Mr. Hoover will consider as a horse of a quite another color. To deliver the truism which we quoted is one thing: to take the responsibility of carrying into effect these principles by the simplest and most direct way is another. Since the real issue is, like all issues, a contested one, Mr. Hoover avoids naming it, and uses safe though otherwise unnecessary circumlocution to avoid the bold and precise word "metric." Yet the case is so plain that it might indeed be well to call a spade a spade.

Oil Wells for Storage Purposes

IT TAKES NERVE to pursue uncharted courses even when there is no alternative. Necessity may be the mother of invention, but courage is not always its offspring. During the war the Anglo Saxon Petroleum Co., in Sarawak, found itself confronted with a situation involving the possibility of serious loss were the wrong decision made. Some loss was inevitable, but the problem was to make it as small as possible. About 30,000 tons of distillate was on hand. Though of a value estimated at about £450,000, there was neither use for it nor storage capacity available at the moment. Its total loss by wastage was threatened. The novel expedient was adopted of pumping it into wells that were known to have almost exhausted the oil sands into which they had been drilled. Thus the entire 30,000 tons of distillate was disposed of, the pump pressure at times rising to more than 100 lb. per square inch. Later on, in 1919, these wells were pumped again, and it is estimated that about 14,000 tons of distillate was recovered in the form of a light crude.

This interesting experiment was described by T. G. Cochrane before the Royal Society of Arts in London this spring. A topping plant of 500 tons' daily capacity had been built, which because of war conditions was operated to produce fuel oil for the navy. This could not be done, however, without producing a distillate at the same time, which was not wanted for war purposes. For the distillate no ordinary means of storage was available, and every tanker was required for carrying fuel oil to some theater of war.

In 1923 the production of petroleum in Sarawak was 560,000 tons, having risen to this figure from 80,000 tons in 1918. Within the British Empire, the oil fields of Burma rank first today as producers of petroleum. Sarawak, which ranked fifth in 1918, is now second in importance. It was in 1909 that the Anglo Saxon company first sought its concession. Today Sarawak Oil Fields, Ltd., operates the petroleum industry of the country. Miri, where the first seepages were found, is said to be no longer a native village, but to have become modernized, affording many of the comforts of civilization to those whose business or work thus takes them to Malaya.

Mining Engineers of Note

Charles H. Munro

CHARLES H. MUNRO spent his boyhood days in Placer County, Calif. In the midst of a hydraulic and drift-mining district it was not surprising that he became interested in mining. In fact, no one can live in a mining camp without absorbing part of the life as well as an intimate knowledge of the mysteries of mining, its ups and downs, and its romance. Munro decided upon a mining career, and after completing his early schooling, he went to the University of California and completed the four-year mining course in 1898. At that time the university was a modest institution. A mining student received excellent training in fundamentals. Student activities apart from the classrooms and laboratories did not encroach any more than sufficient to give spice to a student's routine work. There were rushes and mélees, and excursions to Goat Island, but these were innocent affairs and served as safety valves. Two months after completing his college work, Munro was a full-fledged superintendent, directing the operations of a drift mine, not far from his home town. The young graduate was confronted with a difficult problem: the handling of men much older than himself and many of whom had known him since boyhood. In spite of the fact that Munro had worked with these men, they could not overcome their prejudice against "book miners." However, the embarrassing situation was overcome by the prompt discharge of a few of the old-timers. At that time gold dredging, which had been started in Montana in 1895, began to attract attention in California. Munro went into the Oroville district in 1900 and prospected dredging ground. In 1901, he was employed by F. W. Bradley as superintendent of the Oroville Gold Dredging & Exploration Co. He remained in this position for four years and successfully operated gold dredges and played an important part in developing the practice of gold dredging. During this period and subsequently, the gold-dredging industry expanded greatly. The gold dredge was improved mechanically and increased in size. Manganese and chrome steels were adopted. Oroville became a notable center of the industry, and many dredges were operated. The district has now been practically worked out. The Portland Syndicate engaged Munro as examining and consulting engineer in 1905, and in this capacity he covered the placer and dredging districts of the Pacific states and Alaska and Yukon territory. During the winter of 1907-08, he examined and prospected the Pato properties in Colombia. He recommended their exploitation, which was undertaken by the Oroville Dredging Co., Ltd., of London. The enterprise was successful. From Colombia to Nome, Alaska, is from one extreme to another geographically, but such transitions are not unusual in the life of a mining engineer. Munro became managing director of the Wild Goose Mining & Trading Co. and was in charge of the operations of this company at Nome until December, 1910, when he resigned and accepted the management of the Orsk Goldfields, an English company operating in eastern Siberia. The property was prospected, equipped for operation, and started upon its way. After two years in Siberia, the position of placer engineer was offered to Munro by the Guggenheim Exploration Co., in 1912. This was accepted and was held by him until July, 1923. The period of eleven years was devoted to examination and operating supervision. Part of the time was given to the Yukon Gold Co., at Dawson and other localities. Five years was taken up in obtaining options, prospecting, and starting a tin-dredging enterprise in the Federated Malay States. The position involved a great deal of travel. Many placer deposits in the Pacific States, South America, Canada, and Alaska were systematically examined and explored. Various projects were recommended for exploitation and were started to production. Other enterprises were closed down.

CHARLES H. MUNRO

Few engineers have had the wide experience in examining mining properties and in operating them that has crowded the twenty-six years of Munro's life since he was graduated from California. He has now returned to his home in California and established an office as consulting engineer in San Francisco.

Copper Deposits of Arctic Canada

Eventual Development and Exploitation Seem Certain

By George M. Douglas
Consulting Engineer, United Verde Copper Co.

On the Coppermine River

THE EARLY history of the vast Hudson Bay region includes allusions to "copper mines" from which the Indians were supposed to have derived their supply of the only metal known to them before the coming of the white traders. These "mines" were reported to be on the banks of a river flowing into the sea to the north of Fort Churchill, and were said to be so easy of access that copper could be loaded from them directly on to ships.

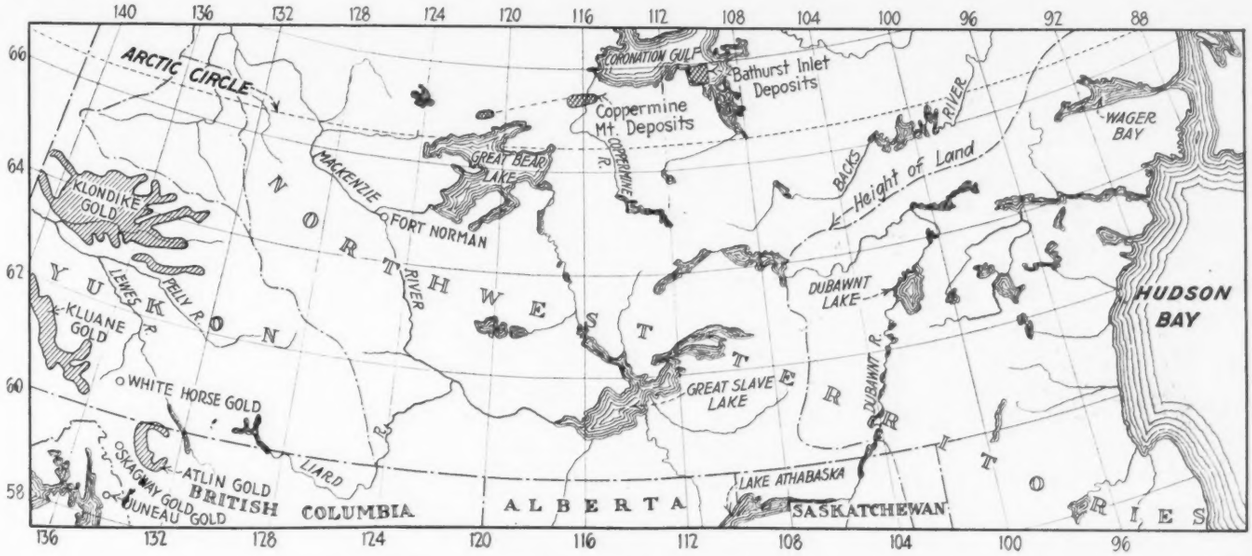
The charter granted to the Hudson's Bay Co. contained clauses committing it to efforts at geographical discovery and a search for minerals in the territory over which trading rights were given. But mining and fur trading are incompatible pursuits; and fur trading was to the English and French in the Far North what mining was to the Spanish in Mexico and South America. A few attempts at mineral exploration were made: among the most notable of these was the journey of Samuel Hearne to the shores of the Arctic Ocean in 1771.

Hearne's starting point was Fort Prince of Wales, at the mouth of the Churchill River, on the west coast of Hudson Bay. The Governor of the Hudson's Bay Co. showed scant interest in the enterprise, and it began badly. Twice Hearne set forth from the fort to find the "copper mines," and twice he was obliged to return because of the rascality of his Indian guides, who stripped and deserted him. On his second journey he had the misfortune to break the only sextant obtainable in the country, and the positions of his third and most important journey were obtained by an old quadrant that seems to have been the only instrument he could procure at the fort. He is scarcely to be blamed for the subsequent inaccuracy of his geographical work. Finally as the insignificant companion of a roaming band of Indians over whom he had scarcely more influence than one of their own women, he made the extraordinary journey from Hudson Bay to the Arctic coast, where the river since called the Coppermine flows into Coronation Gulf.

From time immemorial "Eskimo hunting" had been a favorite form of amusement among the Northern Indians, and on the latter part of this journey the main object of the Indian band with whom Hearne traveled was to encounter Eskimos on their summer migration inland, and to kill some of them.

Following the movements of the caribou herds as they migrated northward, the Indians reaching the limits of their hunting grounds early in the summer. Leaving their families on the edge of the timber, a selected party of braves made a quick journey toward the coast, and after killing a helpless band of Eskimos about ten miles from the seacoast, at what in commemoration of the slaughter Hearne called the "Bloody Falls" of the Coppermine River, their only concern was to get back as quickly as possible to their families and their hunting grounds to the south.

Hearne was quite incompetent to investigate mineral



Map showing the approximate location of the known copper deposits in Arctic Canada

occurrences, and was satisfied with what he describes as a "mere jumble of rocks" hastily pointed out by the Indians as the famous copper deposits. At that time the Indians had given up the use of copper for at least a hundred years, and were probably ignorant themselves of the places from which their forefathers had derived their supply of the metal. Even if it had been from those mountains which cross the Coppermine River, and in which the copper deposits do occur, Hearne's party had struck the river from the east and to the north of those mountains, and probably returned by the same route they came. No doubt the Indians knew that copper occurred somewhere in that vicinity, but there is only uncertain tradition to support the belief that the Coppermine deposits were the main source of the copper supply of the Indians frequenting Hudson Bay. Probably they obtained it from various places; and the "river flowing into the sea" may have been some river flowing into Hudson Bay itself; the Fergusson River, for instance.

It is worth noting that a recent patrol of the Royal Canadian Police has reported a find of native copper to the southeast of Bathurst Inlet, which agrees with Alexander Mackenzie's description of the locality of the Indian "copper mines." Hearne's account of the supposed "copper mines" effectually killed all interest in any such investigations.

British Government Explorations

Fifty years elapsed before the Coppermine Mountains were visited by white men again. In 1820 the overland expedition sent by the British Government to explore the northern coast of the continent journeyed down the Coppermine River on its way to the sea. Captain, afterward Sir John, Franklin was in charge of the expedition, and Dr. John Richardson was one of the members who possessed geological knowledge. Franklin had been instructed to observe mineral occurrences at the Coppermine Mountains, but geographical discovery was of paramount importance to the party. Franklin and his party stopped for one day at the point where the Coppermine River enters the Coppermine Mountains, mostly because they were obliged to do so to dry some musk-ox meat. A tour was made around one corner of the mountains, and Richardson wrote a short description of the character of the rocks. No attempt was made to determine their extent.

In 1836 Thomas Simpson reported finding copper at both the Copper Mountains and at Bathurst Inlet; and similar reports of native copper at the islands in Bathurst Inlet and the Coppermine Mountains were made by David Hanbury in 1903. Both Simpson and Hanbury were impressed by the great extent of these deposits, but neither was a competent observer of mineral occurrences, and both refrained from expressing opinions as to their possible commercial value.

The next and the most serious attempt to investigate these copper deposits was originated by the late Dr. James Douglas in 1911, and I was honored by Dr. Douglas with the charge of an expedition with this object in view. We decided that a small party would do the best preliminary work, and it consisted of three members: Dr. August Sandberg, geologist; Lionel Douglas, my brother; and myself. The following spring we were joined by J. H. Hornby, an English explorer at Great Bear Lake, whose experience of the Far North proved valuable. As we were all experienced travelers we were able to dispense with native help, or to use it only when it happened to suit our convenience and without being dependent upon it.

Our party entered the country by way of the Athabaska, Slave, and Mackenzie rivers. We traveled by means of Hudson Bay Co.'s transport as far as Fort Norman, on the Mackenzie River. We acquired a "York" boat on our way down the river, and loading all our supplies and equipment at Fort Norman we "tracked" it up Bear River to Great Bear Lake by means of Indian help which we were able to get at Fort Norman. A York boat is like a large open skiff; ours was about 50 ft. long by 12 ft. beam, and we had a total load of about three tons on board. We rigged this craft with a large square sail set amidships: her appearance and rig were suggestive of a viking ship, but she was probably a much worse sailer. We were dependent wholly on wind abaft the beam, but my brother and I took watch and watch, and profiting by the continual daylight and any favorable wind, we were able to cross the lake in eight days, and reached the

Bloody Falls on the Coppermine River above the Arctic Circle in Canada

spot where the Dease River flows into Great Bear Lake at the extreme northeast corner, before the end of July.

Dr. Sandborg and I set out by canoe to ascend the Dease River to the Dismal Lakes, and thence by the Kendal River to the Coppermine. My brother Lionel remained to build a log house for our winter quarters. We were able to make some investigations around the Coppermine Mountains during the first season, and spending the winter at our base on the Dease River we returned to the Coppermine early next spring, thus being able to spend most of two seasons on the ground.

Great Extent of Mineralized Area

We made a superficial examination of an area about ten miles across the strike and about the same distance along it; the extent of the mineralized area was found to be much greater than we had supposed. The total width of the belt is about sixteen miles; its length is not known. From float we found in rivers flowing into Great Bear Lake from the north we infer that the same formation as the Coppermine Mountains exists at least a hundred miles to the west of the Coppermine River. We examined only a few miles to the east of the river, and the extent of the formation in that direction is unknown.

Briefly, the Coppermine Mountains consist of superimposed flows of basaltic lava with intercalated beds of conglomerate. The mountains attain a maximum height of 1,000 ft. above the Coppermine River. The southern aspect is abrupt and terraced, making the cross-section easy to observe. The mountains slope about 8 deg. to the north, following the dip of the basalt flows. The strike is consistently about 70 deg. east of south. The mountains are underlaid by limestone.

Copper Occurs in Three Forms

The copper occurs in disseminated form—that is, in minute flakes throughout the basalt; as amygdaloidal copper; and as vein copper in fissures. Several places were found in the Coppermine Mountains where rich massive material and amygdaloidal copper occurred in conjunction and in such quantity as to be most promising for commercial development. In one place we found an exposure of rich sulphide ore. It occurred near the foot of the mountains, and was covered by glacial drift exposed at one place by the action of a small creek. We were not sure whether it was rock in place or the top of a huge piece of float: its further examination required heavier prospecting equipment than we had with us and more time than we could then afford. A good exposure of limestone immediately underlying the basalt was found on the other side of the river near this point, and I am now inclined to think the sulphide was in place.

Dr. Douglas considered the information brought back by our party as so important as to warrant more extensive prospecting. It was considered advisable to await the results of the Canadian Arctic Expedition, and its proposed investigation of the Coronation Gulf deposits, before following up the enterprise. These investigations were made in Bathurst Inlet with important results; but the World War, and its effects upon the copper industry in particular, has since deterred further prospecting.

Deposits at Bathurst Inlet

From 1915 to 1917 the southern division of the Canadian Arctic Expedition, under Dr. R. M. Anderson, carried out various scientific investigations in the Coronation Gulf area. This work was the most important done by the expedition, though it has been obscured by the more spectacular journeys of the northern parties. The investigation of the copper-bearing rocks of Bathurst Inlet remains one of the chief results of the expedition.

This work was carried out by Dr. J. J. O'Neill. He found these deposits to occupy an oval area extending about fifty miles northwest to southeast, with a maximum width of about twenty-five miles. This area includes many islands, varing in size from a few hundred square yards to several square miles. These Bathurst

Outcrops of copper-bearing rock cover wide areas

Inlet deposits are similar to those found in the Coppermine Mountains, and consist of basalt flows with a few thin beds of sediment. Native copper was found practically everywhere in uniform distribution through the groundmass of the basalt. It occurred also in amygdaloidal form in cavities near the surface of the basalt, and as vein copper in fissures. On the south and west borders of this area a series of dolomites underlie the basalts, and in some places bornite was seen to have replaced the dolomite for several feet below the contact. Dr. O'Neill emphasizes the importance of examining these sulphide deposits; and also of looking for deposits of sulphides that might occur in the limestones of the Coppermine Mountains area. He considers the Bathurst Inlet deposits to be distinct from those of the Coppermine Mountains, but the intervening country has never been explored.

Possibilities of High-Grade Ore

The Coppermine Mountains and the Bathurst Inlet areas have thus been proved to contain extensive copper deposits, and it is reasonable to suppose that prospecting would show deposits of high-grade ores at many places. The copper which is generally disseminated throughout the basalt in both areas seldom exceeds 1 per cent. The amygdaloidal beds found by Dr. O'Neill had a copper content of about 1½ per cent; and the thicker beds we found in the Coppermine Mountains showed a content of copper as high as 7 per cent. The sulphides found by Dr. O'Neill contained 49 per cent of copper; those found by ourselves 43 per cent.

We gathered from Eskimo reports that native copper was found in greatest abundance and in the largest pieces along the mountains to the west of the country which we examined. This agrees with the information given to Simpson by the natives more than eighty years ago. We could not examine that part of the country

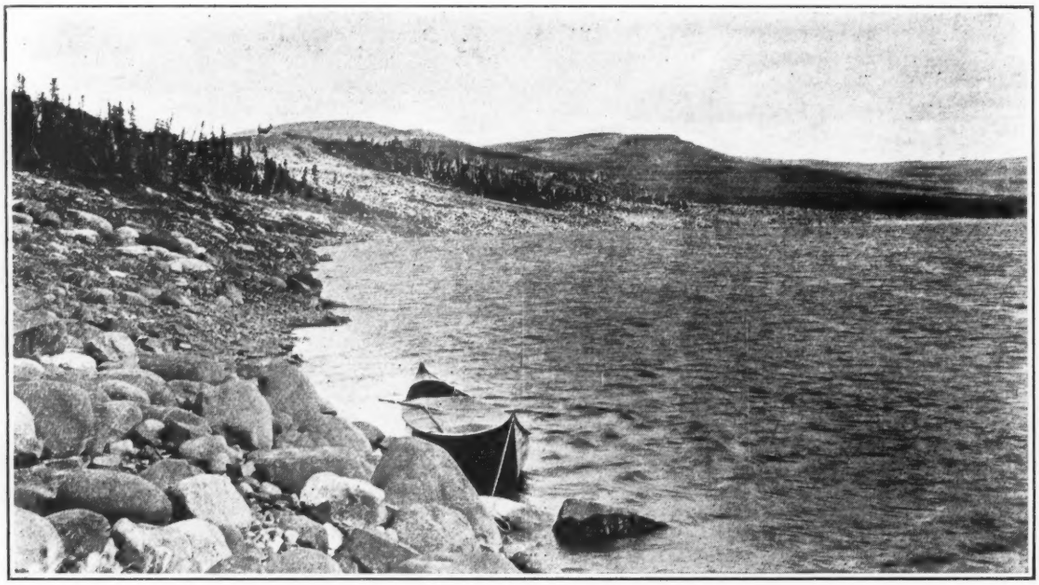
without remaining another winter there, which we were unable to do.

Under the present uncertain conditions in the copper-mining industry there is no immediate pressure to stimulate prospecting and development in regions so remote from railway transport. What the copper demand may be during the next ten years it is not possible to predict at present, but one may hazard a guess that under any circumstances prospecting for high-grade copper ores is likely. During periods of small demand and low price it is only the comparatively high-grade mines, with a flexible production and costs that may be held fairly constant at different rates of production, that will pay at all. Improved methods have made it possible to work low-grade deposits to advantage under certain conditions: the conditions of the period 1908-1918 were such as to stimulate enormous development of low-grade deposits. How inflexible are those conditions under which low-grade deposits may be worked at a profit has been demonstrated by the course of events in the copper industry since 1918, and most especially since 1922.

The Coppermine Mountains and Bathurst Inlet areas are both of a most promising character for prospecting for high-grade ores. I should consider the former area the more favorable for serious prospecting, as it is more accessible than Bathurst Inlet, and perhaps even more promising. The presence of timber large enough for housebuilding, and for fuel is a great advantage for preliminary work.

The route for the transport of light supplies for the establishment of bases, and for the first two or three years of operations, would be by way of the Mackenzie River and Great Bear Lake. Communication by airplane from Edmonton, after bases had been established in the Coppermine Mountains, would be easy. Heavier supplies for subsequent operations would be shipped in by sea, and brought by scows up the Coppermine River. The distance from the mountains to the sea is about sixty miles, and the country would be an easy one for building a light railway.

There has been a persistent assumption of late that the public labors under many delusions regarding life in the Arctic. Though not agreeing with some of the more enthusiastic propaganda offered as to the friendliness of the Far North, I should nevertheless describe the country between Great Bear Lake and Coronation Gulf as a pleasant and healthful one at any time of the year. The winters are cold, but the cold offers no more obstacle to mining operations in the Coppermine Mountains than it does on the Keweenaw Peninsula, or in northern Ontario. The snowfall is light; the ground is bare from the first week in May till the middle of October. The country is remote, but otherwise it may be described as an exceptionally easy one for prospecting and preliminary development—far easier, for example, than northern Ontario.



Both the river and mountains have the name Coppermine

Speaking of the possibilities of mining enterprises in this field, Dr. James Douglas, at the annual meeting of the Canadian Mining Institute at Ottawa in 1913, said:

"One has to recollect that for many years the Keweenaw promontory of Michigan was cut off from all communication with the market except during the comparatively few months of open navigation; that supplies of fuel and merchandise were conveyed by water to the mines before navigation closed, and that the copper accumulated on the peninsula until navigation opened the following spring. The open season was of course longer than it would be in the Arctic Ocean, and the climate of the Arctic is more severe than in Michigan, the thermometer dropping occasionally to 40 and 50 deg. below zero. The fall of snow, however, as reported on the Dease River, did not at any time exceed 2 ft.; and therefore mining, ore concentration, and smelting, as well as railway transportation, would not be conducted under conditions much more onerous than in the Province of Quebec, or in Michigan."

Transportation Problem

Testing and preliminary development of either field would require at least four or five years, and the transport routes for such preliminary work, and even for commercial mining on a small scale, would be by sea and by the Mackenzie River-Great Bear Lake routes. For commercial mining on a large scale a railway would be

necessary, and the best route for such a railway would be from some point on Hudson Bay, connecting with the nearly completed Hudson Bay Railroad.

A third area of great promise for mineral deposits, especially copper, is on the shores of Hudson Bay, between Chesterfield Inlet on the north and the Fergusson River on the south. This region is comparatively accessible; and, most important, it is the gateway to the development of the copper fields already mentioned. It seems strange, but nevertheless only one competent observer has ever visited this region.

In 1895 J. B. Tyrrell passed along this part of the coast after his journey from Athabaska Lake to the hitherto unexplored Dubawnt River. He descended this river to Aberdeen Lake, and thence by Chesterfield Inlet to Hudson Bay. His journey is one of the most notable in the history of the exploration of northern Canada. It was late in the season by the time Tyrrell's party reached the sea after its long and arduous journey through an unknown country. The condition of the members of the party was precarious, and their prospects of reaching the nearest Hudson's Bay Co.'s post at Fort Churchill were very doubtful. They were traveling by canoe: even in these light craft the shallow water obliged them to keep clear of the land. The imperative necessity for fast travel and the first snows of winter permitted only scanty opportunities for examination. But the country between Chesterfield Inlet and the Fergusson River was found to be most promising from a mineral point of view, copper in the diabase being found at almost every place the party landed.[1]

The commercial development of the Coppermine and Bathurst Inlet deposits may seem remote and impractical at present, especially to American copper producers. But if high-grade copper ores were to be found near tidewater on Hudson Bay, commercial mining would be entirely practicable. And, furthermore, if successful mining were to be started on Hudson Bay, the Coppermine and Bathurst Inlet deposits, instead of being of remote or merely academic interest, would become matters of acute and immediate importance. At present these areas are withdrawn from "staking" by an Order in Council. The capital required for their development would be large and could be furnished only by some group of strong financiers. No company could attempt operations unless its future were secured by liberal concessions, but it is reasonable to suppose that such concessions would be granted to a responsible organization giving proofs of ability to prosecute the work, and of good faith and serious intentions.

[1]Part F. Annual Report, Vol. IX 1896, Geological Survey of Canada.

Details of Hollinger's Mining and Milling Costs

THE 1923 report of operations of the Hollinger Consolidated Gold Mines Co., Ltd., of Timmins, Ont., the largest gold mining enterprise in North America, gives a comprehensive analysis of the cost of conducting its operations.

Milling results were as given in the following table:

Milling Results in 1923

Tons ore milled	1,366,352
Average value per ton	$7.93
Gross value	$10,841,106.20
Deduct loss in tailings	394,694.0
Net value recovered	$10,446,412.20
Average tons per day	3,764 tons
Per cent of possible time run	83.4 per cent
Tons per 100 per cent running time	4,513 tons
Stamp duty per 100 per cent running time	20.06 tons
Solution precipitated per ton ore	1.76 tons
Value per ton in tailings	$0.29
Cyanide consumed per ton of ore	0.424 lb.
Zinc consumed per ton of ore	0.111 lb.
Zinc consumed per ton of solution	0.063 lb.
Lime consumed per ton of ore	2.645 lb.
Lead acetate per ton of ore	0.012 lb.
Average value pregnant solution	$4.33

Distribution of General Charges

GENERAL	Per Ton Ore Milled
General charges	$0.1796
Administration	.0597
Insurance	.0130
Clearing surface and roads	.0067
Operating camp	.0294
Operating boarding house	.0021
Alteration to plant	.0019
Marketing bullion	.0377
Fire protection	.0341
Workmen's compensation	.0585
Total general charges	$0.4227

RECAPITULATION	Per Ton Milled
Total general charges	$0.4227
Total mining charges	3.2931
Total milling charges	1.1436
Grand total	$4.8594

Distribution of Mining and Milling Charges

MINING	Per Ton Milled
General mining charges	$0.0401
Superintendence	.0923
Diamond drilling	.0670
Crosscutting	.1570

(Distribution of Charges, continued)	Per Ton Milled
Drifting	.2118
Raising	.0213
Sinking shafts	.0757
Timbering shafts	.0395
Stoping	.8724
Scaling	.0778
Timbering stopes and raises	.1675
Re-timbering	.0426
Back-filling	.0283
Track-laying	.1387
Tramming	.4253
Electric haulage	.0823
Extending electric haulage	.0147
Pipefitting underground	.0844
Mine drainage	.0403
Hoisting	.1376
Landing and dumping	.0422
Drill repairs	.1189
Sharpening steel	.0706
Distributing steel	.0616
Mine sampling	.0442
Change house	.0149
Mine lighting	.0153
Excavation	.0204
Surveying	.0400
Assaying	.0472
Ventilation	.0006
Alterations	.0006
Total mining charges	$3.2931

MILLING	Per Ton Milled
General milling charges	$0.0622
Superintendence	.0431
Tailings disposal	.0398
Heating	.0211
Lighting	.0102
Mill power plant	.0166
Shoveling in bins	.0030
Crushing	.0853
Conveying	.0344
Stamping	.1345
Classification and tube milling	.1732
Concentration	.0349
Treating and handling concentrates	.0374
Handling pulp	.0154
Thickening pulp	.0092
Cyanide	.0913
Agitation	.0306
Continuous decantation	.0276
Filtration	.0177
Oliver filtration	.0358
Neutralizing	.0236
Refining	.0239
Clarifying and precipitation	.0454
Pumping solution	.0140
Cleaning mill	.0028
Mill sampling	.0052
Ball mill	.0690
Assaying	.0236
Maintenance of buildings	.0014
Experimental	.0114
Total milling charges	$1.1436

A Professional Problem

By T. A. Rickard

A FEW DAYS AGO a mining engineer, an old acquaintance in Colorado, came to me for advice. The problem that he presented for discussion is one not uncommon in these days, when the scope of opportunity for members of our profession seems to be shrinking. My interrogator, for he came to ask for information and advice, is in mid-career; he is old enough to have had a wide experience; he is young enough to be able to look forward to many years of active work; and, it is most important to note, he has several children just about to go to school. So he wishes to avoid living in an isolated mining district; he wants to reside near a city that can provide the kind of schools needed for the education of his children. A few years ago, after holding the position of resident manager at several mines in the mountains of the West and Northwest, he decided to open an office as consulting engineer in a large city. This he did for the sake of his family and in the belief that his work as mine manager had made him known to a clientele large enough to assure him a reasonably good practice as a consultant. At first the new departure proved successful; he was engaged to examine mines sufficiently frequently to yield him a fair income. One or two retainers helped to keep the pot boiling. He seemed to have fallen on his feet. But this satisfactory state of affairs proved as non-persistent as the gold in a gash-vein. He finds it difficult now to occupy himself profitably. What shall he do?

He answered the question himself by proposing to go on a search for a likely gold mine and then getting some of his clients to provide the capital for its development. The scouts of the larger exploration companies, he argued, looked only for prospects that had the making of large mines; he would make it his particular business to look for those that promised to be properties of smaller capacity, but the basis of a nice, profitable enterprise, quite big enough for a group of men of moderate means. He believed that mines of medium size and moderate productiveness were overlooked by the engineers of the established financial corporations and that therefore he would have a good chance to engage in profitable business.

To this I demurred, saying that the present dullness in mining affairs extended to the business of promoting mines, and that the chances of finding both a suitable purchaser and a suitable prospect were small. But, as Senator Johnson said, "one has to eat," or, more explicitly, a man with a family to support may not be in a position to choose his way of making a living. Which is true enough; but I suggested that the mental pose of the promoter was optimistic necessarily and that to indulge in it might have the effect of vitiating his judgment as an appraiser of mines for others. A promoter to be successful must not be hampered too much by facts; in other words, he cannot be "from Missouri" and maintain the critical attitude essential to the correct valuation of mines. Why not then make a change of occupation for a time? A mining engineer has had a training that fits him to do other things well: for example, construction work; a metallurgist at a loss for employment should find it in some manufacturing enterprise involving the application of chemistry.

Perhaps some of my readers can proffer better suggestions, which, I believe, will be welcome to many that are in the same quandary as the friend from whom I have quoted. It is to be noted that the malaise that seems to afflict mining so adversely just at this time is of a temporary character. It is due to conditions in Europe, where the metal markets are depressed by the after-effects of the war, and it is due also to the high rate of money, for when 6 per cent can be obtained safely there is less inducement to speculate in mining operations than when gilt-edged investments pay only 3 or 4 per cent. These conditions are temporary; a change seems to be imminent, for mining is a basic industry, the continued development of which is as essential to civilization as agriculture itself.

It is true, and the fact must be faced, that the practice of the independent consulting mining engineer and consulting geologist suffers from the modern tendency to consolidate mining companies and to operate in large units. The number of clients is decreased thereby; the plums in the professional cake are few and large, whereas formerly the cake was full of raisins of medium size. Consulting practice is not what it used to be twenty or thirty years ago, when so many of the mines in the West were controlled by small companies and mine operators did their business individually rather than in the groups now known variously as exploration or development companies. The mining practitioner must, as I suggest, face this fact, and unless he can obtain one or two retainers sufficient to serve as the basis for a steady occupation, he had better forego the allurement of an office on his own account.

As for those free from family responsibilities—the unmarried members of the profession—one can give advice to them with more confidence, for they must find less difficulty in facing the cost of living, or even the cost of high living, with which most of us are perplexed in these United States. To a young engineer out of employment, for the moment, I venture to suggest that he should utilize his period of disengagement by preparing himself for the opportunity when it comes, as come it surely will to any man of energy and initiative. Let him study his subject, by reading books and by visiting localities where the latest technical practice is illustrated. Also, let him make use of this slack period to gain a larger acquaintance among the members of his own profession, both for the sake of the human interest implicit in such an acquaintance and for the chance that through others he may hear of something that he can do advantageously. In life, as in music, the interval has a value of its own. The French proverb says that all comes to him who knows how to wait—not to him who merely waits aimlessly, but to the man who has used the time of waiting sagaciously.

To our younger comrade, as to our older brother, I submit the cheering thought that mining is not a fashionable pursuit or a temporary diversion; on the contrary, it is an industry on which civilization is founded and on the products of which it depends for its progress. So there need be no fear of any long-continued depression.

Bonds of Copper-mining Companies

An Analysis of the Position of These Securities in Corporate Finance

By W. F. Boericke
Mining Engineer, Philadelphia, Pa.

W. F. Boericke

SINCE 1916 the large copper-mining companies have offered and sold more than $240,000,000 of their bonds to the investing public. This does not include the bonds of some of the smelting companies. which though drawing a large portion of their revenue from the copper mines they control, are not directly dependent on the industry. This financing, though differing widely in the character of the several bond issues, possesses one point in common—a huge amount of capital was raised by offering secured obligations of the companies, bearing definite, known interest rates, with the chance for speculative price appreciation largely eliminated in all cases, except in those issues having a convertible feature. In other words, the funds have been supplied by the investing class rather than from the speculators who look for their profits from the rise and fall of ticker quotations, and are not satisfied with the comparatively small fluctuations of a well-secured bond. This point is of interest because it was formerly the practice to raise new capital for metal mines either by new stock flotations or by assessments on old shares. Mining stock as a simon-pure investment was necessarily frowned on in conservative circles, however attractive it might be to a speculator. This new financing, however, takes its legitimate place with other industrial bonds, and competes for funds with the obligations of the other great industries of the country.

Details of Bond Issues

Table I gives the salient details of the more important bond issues of the copper companies since 1915. The term "secured obligation" is used to distinguish from debenture, which, though a direct obligation, is not secured by a mortgage. The former, though likewise not secured by a mortgage, distinctly provides that the assets of the company shall not be mortgaged or pledged without equally securing such bonds under the mortgage. Necessarily, this has the effect of making them coequal with a first mortgage issue, and so raising their investment rating above that of an ordinary debenture.

Table I—Important Mining Company Bond Issues

Company	Amount	Dated	Due	Security	Coupon Rate	Sinking Fund	Convertible Feature
Anaconda	$30,440,000	1919	1929	Secured direct obligation	6%	Yes	No
Anaconda	100,000,000	1923	1953	First mortgage	6%	Yes	No
Anaconda	50,000,000	1923	1938	Debenture	7%	No	Yes
Braden	20,000,000	1916	1931	Collateral trust	6%	Yes	No
Kennecott	15,000,000	1920	1930	Secured direct obligation	7%	Yes	No
Chile	35,000,000	1917	1932	First mortgage	6%	No	Yes
Cerro de Pasco	8,000,000	1921	1931	Secured direct obligation	8%	Yes	Yes
Magma	3,600,000	1922	1932	Secured direct obligation	7%	Yes	Yes
Tennessee Copper	3,000,000	1915	1925	First mortgage	6%	Yes	Yes

In most cases a sinking fund for an industrial bond is a prime requisite both for safety and for maintaining a satisfactory market. Often in industrial underwritings an alternative is made by offering serial maturities of the bond, a certain amount becoming due and payable every year, thus reducing the principal by substantial amounts annually. This particular method has not been employed in copper financing, except in the case of the Copper Export Association 8s, since retired. But the majority of copper bonds have sinking funds of generous amount, and the investor would do well always to insist on such a provision in a mining bond. The ore in the ground, in the final analysis, is the main security behind the bond. Buildings, equipment, machinery, however valuable and costly, take on only a junk value when the ore is gone. As ore reserves tend to depreciate and grow steadily less as they are cut into, unless augmented by future discoveries, some provision must be made to reduce the mortgage held against such reserves, and this is the function of the sinking fund. This should be of sufficient size to retire such an amount of bonds annually as to leave only a nominal amount outstanding at maturity.

Working of Sinking Fund Important

The operations of the various sinking funds is of interest in showing the safeguards adapted to protect the investor. Table II gives details of such sinking funds.

Table II—Sinking Fund Detail

	Sinking Fund
Anaconda 6s, 1929	$1,500,000 annually
Anaconda 6s, 1953	$750,000 semi-annually, increasing to a figure sufficient to retire all bonds by maturity.
Braden 6s, 1931	Semi-annual, for 3½ per cent of total bonds outstanding, increasing with amount of ore mined beyond 3,600,000 tons annually.
Cerro de Pasco 8s, 1931	$840,000 annually, not less than 20 per cent of net earnings.
Magma 7s, 1932	$1.50 per ton for each net ton of ore treated during calendar year.
Tennessee Copper 6s, 1925	46½c. annually on each ton of copper ore mined.

In three issues, the Kennecott 7s, the Chile 6s, and the Anaconda debentures, no sinking funds are provided. With the latter two, there are attractive convertible features, which, it is anticipated, will operate before the maturity of the bonds to convert the greater part of them into stock, and so relieve the company of the necessity of paying them off or refunding them. The Kennecott issue is comparatively small, in relation to the enormous stock equity behind it.

Of the bond issues with sinking-fund provisions, only the Anaconda issues do not have some reference to the result of actual mining operations in determining the amount of such payments. Definite amounts in cash are specified with Anaconda. The smaller issues properly make the sinking-fund payments vary either with net profits or with the results of mining operations, in each case assuring the bond holders that their interests

will be protected in the event of an exceptionally prosperous year, or of extraordinary exhaustion of the orebody. This policy has of course been copied from the custom of coal mines in setting aside a sinking fund for their bonds of so many cents per ton of coal mined, and is sound practice.

A larger company, such as the Anaconda, the operations of which embrace other fields besides actual mining, has more liberty to dispense with exact provisions as to the special source from which sinking-fund payments shall be derived.

Market for the Bonds Assisted by Sinking-Fund Provision

The existence of a sinking fund has the further important provision for the bond holder of serving to establish a stabilized market for the bond, regardless of whether the issue is listed or not. It may be remarked here parenthetically that no greater fallacy exists than that prevailing in the minds of laymen generally, that the mere fact of listing an issue insures marketability. But the market price of securities having a sinking fund operating regularly always shows a merited stability, whether listed or not, and frequently results, in times of panic or depression, in giving an artificial stimulus to the quotation.

Some companies, in an effort to make their bonds appeal not only to the conservative class of investors, but to the speculative as well, have made them convertible into stock on some specified basis. Table III gives details of the conversion feature.

Table III—Conversion Provisions

	Conversion Feature per $1,000 Bond
Anaconda debenture 7s, 1938	Into stock on varying scale—first $10,000,000 at 53, second at 56, third at 59, fourth at 62, fifth at 65.
Chile 6s, 1932	Into stock at $35 per share
Cerro de Pasco 8s, 1931	Into stock at $33.33 per share
Magma 7s, 1932	Into stock at $33.33 per share
Tennessee Copper 6s, 1925	Into stock at $40 per share

Convertible bonds cannot be regarded as simon-pure investment securities. They necessarily partake of the nature of both stocks and bonds, and this fact is usually revealed in the price at which they sell on the market. This is not to say that a convertible bond may not be a thoroughly desirable security, but from a strictly *investment* standpoint it must be considered solely as a bond, stripped of its convertible feature. It is unlikely that the bond will measure up to *all* of the requirements of a safe investment, if it were found necessary to include the added inducements of possible speculative profits from future conversion into stock.

The convertible bond from the company standpoint has the possible advantage of its being all converted into stock before or at maturity, thus eliminating all need of payment or refunding. However, if a company is in so sound a financial condition that its stock sells at a premium on the market above the conversion figure, there would probably be little trouble in financing the payment of the bonds with consequent benefit to the original stockholders, whose interest in the property would not be decreased by the inclusion of the converted bondholders.

Convertible bonds invariably sell on a speculative, rather than an investment, basis, except where the possibility of stock conversion is remote. The tendency is for such bonds to sell above their intrinsic investment value, anticipating marketwise a movement in the stock which would make their conversion profitable to the bondholders. Hence, price variations are extreme, in comparison with seasoned investment securities. For instance, if a certain 7 per cent bond is convertible into stock at $40 per share, the price will tend to rise steadily above par as the stock approaches $40, and will tend to maintain a margin above the conversion figure, depending on the activity of the stock and its possibility of further appreciation. This may frequently reach such a point that the bond sells on only a 3 or 4 per cent income basis, and becomes then in only a small sense an investment. When this stage is reached, an interesting stock-market maneuver may sometimes take place, the bonds being bought by speculators who are short the stock, and who take this means of hedging on their commitments, resulting in still further price confusion.

Advantages of Convertible Bonds

To those who are able to take a "business man's investment," the convertible bond offers many inducements, but they should be honest enough with themselves to decide in advance whether they want profits or income, and, if the latter only, to disregard all save the intrinsic merit of the security *as a bond*. On those rare and memorable occasions when the mining engineer is in the market for an investment, or perhaps is consulted on the worth of a mining bond, it is necessary to have clear ideas on the matters discussed in the foregoing part of this article. If the income alone is desired, the more conservative issues should be chosen; if profits, then the convertibles. But it is seldom both factors can be obtained in the same security.

The record of copper-mining company bonds, though still almost in their infancy compared with the rails, utilities, and many industrials, has been generally good, and present market prices reflect a good investment rating for them. Table IV gives the high and low price for the various issues during the current year (January to May) and the percent of fluctuation. For purposes of comparison, four standard industrial issues are included at the end.

Table IV—High and Low Prices of Principal Coppers, January-May, 1924

First-Grade Bonds	High	Low	Fluctuation, in Per Cent
Anaconda 6s, 1929	103	100	3
Anaconda 6s, 1953	99	95	4
Braden 6s, 1931	103	100	3
Kennecott 7s, 1930	105	102	3
Chile 6s, 1932	101	99	2
Tennessee Copper 6s, 1925	102	99	3
Second-grade Bonds			
Anaconda 7s, 1938	101	95	6
Cerro de Pasco 8s, 1931	144	125	19
Magma 7s, 1932	117	110	7
Industrial Bonds ("A" Rating)			
Bethlehem Steel 6s	100	96	4
American Agricultural Chemical 7½s	101	82	19
Armour & Company 5½s	92	87	5
Sinclair Oil 7s	97	88	9

There has never been any question in the minds of intelligent investors that the bonds of coal-mining companies, issued under proper restrictions, were safe. Where the coal lands were owned in fee, the bonds amounted to real-estate mortgages on coal deposits, of known and calculated extent. When the value of the coal in place was substantially in excess of the bond issue, there was a substantial asset value behind the bonds, which could not be destroyed. Furthermore, the costs of coal mining in any particular district were fairly well known in advance, and market fluctuations were not ordinarily a factor of prime importance. Good management was essential for success, but the experience of other companies in the same field could always be used as an index of what could or could not be expected.

With copper companies, the investor cannot always figure with such mathematical exactness on ore reserves, though with most of the companies under discussion no concern need be felt. Two factors enter in, however, to a much greater extent than in coal mining, and should have a greater weight with the investor—management, and the market price of copper. The great copper properties are generally widely separated, and each has its special and particular problems. Little indication of the success of one property can be had from the experience of another, situated perhaps hundreds of miles away, with wholly different operating and metallurgical treatment of the ore. Hence the operating history of the property must be investigated to determine whether a sufficient margin of profits has been shown over a term of years, and whether the management has shown itself capable.

The wide fluctuations in the price of copper produce equally great and often exaggerated movements in the companies' junior securities, but to only a minor extent will they affect the companies' prior-lien bonds. The latter will, however, register a sympathetic movement with the rise or fall of the stock, reflecting the increase or decrease of the equity behind the bonds. Where fixed charges have been covered by a company over a term of years with an average satisfactory margin, under varying market conditions, such fluctuations need cause little concern to an investor. In theory, any conservation in cash resources at the expense of the stockholder, such as omission of dividends, should strengthen the position of the bond holders and improve the price of the bonds. Illogically enough, it usually has the reverse effect on the quotation.

The purpose of bond issues by any industrial should be specific, and result in an increase of fixed assets—that is to say, in an increase in income-producing property for the company. The not-unusual practice of using the proceeds to increase working capital, or to fund current banking indebtedness, cannot be recommended as the soundest kind of financing. New capital requirements can best be provided by bond issues when the proceeds are to be used for productive assets, such as a new smelter, new railroad construction, or the reimbursement of the company's treasury for previous capital expenditure. If such is the purpose of the financing, and the bond complies with the other principles of safety suggested above, copper-company bonds are entitled to an excellent investment rating. Over a term of years it can be expected that constantly increasing demand for metals will result in an enhanced price for copper and a larger margin of profit.

It is not to be expected, however, that bonds issued by the small mine will ever be popular. The difficulty of blocking out a sufficient tonnage of ore to justify a long-term bond is an almost insuperable objection. Without such assurance, the most elaborate mill and equipment will not offer an adequate security. Financing of a smaller property is therefore best accomplished by the time-honored method of selling stock, where the possibility of large profits will compensate for the additional risk involved in the venture.

Use of Oxidizing Agents in Roasting Ores for Leaching

A recent English patent (No. 210,824; Oct. 10, 1922) covers the addition of oxidizing agents, such as saltpeter, to ores before or during calcination to render them more amenable to leaching processes, according to an abstract in *Chemistry and Industry*. Some ores, namely, pyrites containing lead, tend to cake during roasting. Such ores are subjected to a preliminary roasting, and the mass is broken up before the addition of the oxidizing agent. With some silver ores, containing pyrite, the silver is rapidly brought into a condition suitable for oxidation; hence the addition is made at the commencement of the operation. In the roasting of complex blende ores of silver, the ore does not become susceptible to oxidation until the end of the process, and the addition of the oxidizing agent is delayed until the conditions are favorable. It is preferable to roast silver blende ores and pure silver ores in a muffle furnace, so that the ores be not contaminated by the fuel.

The End of a Successful Prospecting Trip

Though metal mining is the chief industry of Northern Idaho, fishing has an importance all its own

How Not to Invoice Supplies

A Purchaser Criticises Some Manufacturers' Methods

By a Mine Superintendent

IN THIS AGE of standardization and efficiency engineers it often happens that an overdose of so-called efficiency is applied. Our large corporations and industries can well afford to maintain what may appear to be an excess of clerical help in their office organizations, so that the most carefully detailed costs and operating data may be kept, provided these are studied regularly and intelligently. If such study is not made and such detailed information is assembled merely as a matter of form or routine, then, though there is the appearance of efficient management, in reality it is a waste of time and money. As the size of the operation and its organization decreases, so also must the amount of detailed information gathered and tabulated decrease until we reach the point where one or two men often have to do all the office work connected with an operation which may run into $50,000 or more per month, with 100 to 200 men on the payroll. It is needless to say that, in this latter case, the simpler the system of office procedure the better, and that the checking up and paying of invoices for supplies is an important matter. It is this particular phase of the routine work that will be discussed, and it might be well to explain that I have had personal experience in this, both with large and small organizations. Certain data should appear on all invoices, and the different items will be taken up separately. To simplify matters, the manufacturer or producer will be called the "seller" and the purchaser, the "buyer."

PURCHASING agents, warehouse men and all concerned with the ordering and checking of machinery and other supplies, may find in this mine superintendent's criticisms echoes of their own complaints. Some manufacturers give careful attention to the details of invoicing, in their own interest as well as in that of their customers, but it is true that others do not. The latter doubtless fail to picture to themselves the conditions surrounding the buyer and his work and the difficulties that carelessness in invoicing may entail.

Seller's Name and Address—This should be the main outstanding printed name on the invoice and should be the name of the company or individual who makes the sale. In the case of an agent or commission firm, the invoice should be in their name if payment is to be made to them. This practice is seldom varied. As to the address, the buyer naturally assumes that the address given with the seller's name on his invoice is the proper place to write for any information regarding the invoice or the order for which it stands. I have in mind a certain large manufacturing concern which has its office in one city we will call *A*, and where the original order of the buyer was placed; the order was forwarded to the company office in city *B*, a few miles away; further correspondence in regard to the order was taken up with this office in *B;* however, the factory was actually situated in city *C*, and the invoice requested remittance to city *C*; as a final step, the material was really shipped from city *D*, as indicated by the packing list, yet the bill of lading states that shipment was made from city *E*. This may seem ridiculous, yet I have all these papers in my file. The firm referred to in this case might say that *B*, *C*, *D*, and *E* are all suburbs of *A* and that the apparent multiplicity of offices gives them no concern; however, the buyer may not know this, and if trouble arises regarding the order, necessitating telegrams and correspondence, much time may be lost and annoyance caused the buyer.

Buyer's Name and Address—This is, of course, the second most important heading on the invoice and should be the name of the buyer, with his office address, to which address all communications, papers, bills of lading, and invoices should be sent. I wish especially to call the attention of shippers to this point, as it is one that is probably more flagrantly disregarded than any other. In our own case, our orders plainly read to send all invoices and correspondence to the office named on the order. In spite of this, many of the largest supply houses in the country persist in sending bills of lading, packing lists (copies), correspondence and occasionally invoices to the place designated as the receiving point for the shipment. We are or have been receiving material at three different railroad stations and one blind siding, where there is no post office. In this latter instance, much inconvenience has been caused both buyer and seller when certain papers were addressed to the railroad siding, and sent either to the dead letter office or returned to the sender, marked "no such place" or the equivalent. We usually get any letters mailed to the other towns, but only after an aggravating delay. The business of mining, in which we are engaged, necessitates the shipment of goods to various places, and the seller cannot know whether these designated points are towns or sidings, or whether or not the buyer has a representative there. He, the seller, can never be criticized, however, if he forwards *all* communications to the office indicated in the order on which the goods were bought, except when special detailed instructions are occasionally given.

Date of Invoice—This is merely mentioned as one of the essential items to appear on an invoice.

Invoice and Cases Should Show Buyer's Order Number

Order Numbers of Buyer and Seller—Every invoice should have on it the number or date of the buyer's order on which the goods are bought. As a rule it is safe to say that the seller will have his own shop or order number indicated. Regarding this I would like to offer a plea for fairness. Most large concerns number their orders in some way for identification, and re-

quest on their order that this number be placed on all communications and on the machines or outer wrappings or boxing when shipped; yet I venture to say that 75 per cent of the goods received by us, and I do not believe we are any exception to the general rule, have no markings on the outside, by which the contents can be identified. In many cases they will have the seller's order number on, because the seller's shipping clerk is particularly interested in checking out his own shipments against his orders; but an attitude of utter indifference is expressed toward the receiver of the goods. In other words, and from the viewpoint of the buyer, it appears that the seller, when he has obtained the order and filled it and put the goods on the cars, is done; it does not matter to him if the buyer has no warehouse to receive and unpack all shipments received, and where he can see that they are sent to the proper plants. In order that this point may be thoroughly brought out, I will cite an instance:

We were operating a mine several miles from the railroad siding at which we received the greater part of our freight; the mine was situated a mile from the mill and offices and in addition, a large boarding house was being operated. Owing to local conditions, much of the freight for the mine was hauled directly to it, and the same was true of the boarding house; freight, coming in boxed, could be identified only by the name of the seller unless our order number was on it, and, therefore, the presence of this order number was an extremely important factor in the proper disposition of the goods; it has often been necessary to telephone the freighters to break open a box to see what was in it, so that we would know where to send it. This is not an exceptional case and can easily be understood by mine operators in sparsely populated regions.

Number of Invoice—Many large concerns number their invoices and request that such number be used in all correspondence relating to that invoice. This is an excellent practice, much more satisfactory than the use of dates, and of great assistance to both buyer and seller in handling the accounts. Where numbers are not used, it is customary for the buyer, in paying or writing about such an invoice, to refer to the seller's order number or the date of the invoice. All invoices should have some definite symbol which positively and immediately identifies the invoice, and this symbol should be prominently displayed on the invoice.

Shipping Instructions—It is customary for the seller to have a regular place on his invoice where is designated the point to which the material is shipped and to whom. This is necessary because many companies purchase through a central office, and this office, with its address, is the one whose name should appear prominently on the invoice as the party to whom the goods were sold and to whom all correspondence should be directed. Also, subsidiary companies, with various names, may be the recipients of the goods, though all financial matters may be handled through the central office. In this connection the invoice should plainly state how the goods were shipped, whether by paid or prepaid freight, mail, or express; also from where the goods were shipped and when. It is usually assumed that goods are shipped within the twenty-four hours preceding the date of the invoice, when no date of shipment is given, but this is by no means always so; if there is delay in the receipt of the goods and an investigation is necessary, the above-mentioned date is important.

Payment of Invoices—Unless instructions to do differently are printed on the invoice, payments are generally made to the seller's name and address as it stands at the head of the invoice. This brings up the matter of companies with branch houses in different parts of the country. I have in mind the instance of a certain company with branches from coast to coast. We were situated in a Far Western state, and our order was placed with this company's branch in Salt Lake City, Utah; shipment of the goods was made from Salt Lake City and the invoice, originating in Salt Lake City, came along in due course. This invoice had, at the head, the name of the parent company; under this was the name of the subsidiary company manufacturing the article ordered, with the latter's address in a city on the Atlantic Coast; also, there were definite printed instructions on this invoice, to "forward all remittances direct to the ——— Company" (the parent company) at the city on the Atlantic Coast. These instructions were followed, and some time later a letter was received from the New York office, stating that our check had been forwarded to them (the New York office of the parent company) by the subsidiary company at the Atlantic Coast city above mentioned. It seems incredible that "big business" continues such practices; yet these invoices are going out daily and are supposed to be paid to the New York office, although that office is not indicated in any way on the invoice—the buyer is apparently supposed to have "second sight" or be a mind reader.

Terms of Payment—These should be and generally are printed on the invoice and are mentioned merely as a necessary item to appear on the invoice. When not so printed, they should appear in the body of the invoice.

Distribution of Data on Invoice—There is much room for improvement in the arrangement of the various headings on invoices. A better grouping of this data might well be made, where it consists, as is often the case with large corporations, of many items. A manufacturing concern will often have at the head of its invoices a place for shop number, requisition number, order number, customer's order and requisition number, date shipped, where from and how, invoice number, date, and possibly other items. No two companies will have the same sequence of headings or groupings, and that is hardly possible; but at least they can group all data referring to the customer in one place, and data referring to themselves in another. Then the customer does not have to hunt around through a maze of dates and figures to be sure he has his own when checking up. For instance, it is a favorite practice to have the following sequence: "Our (seller's) order number, customer's order number," etc. It may easily happen that these numbers are somewhat similar or have the same number of digits, and the "customer" may hunt up the file under the wrong number and not become aware of it until he finds such file and discovers it to be the wrong one or that there is no such file.

Bills of Lading and Packing Lists—The matter of forwarding these, or copies, to the office specified on the order and not to the point of shipment has been referred to. There remains the very common practice of merely attaching the bill of lading to the invoice and forwarding them together. For example, we will consider orders for widely different commodities, such as groceries and drill parts, and assume that these are

being ordered quite regularly and often in quantity; also that the supply companies have several branches. It often happens that such orders will be split up, and portions shipped from different branches, shipments occasionally being made on the same dates from different points by prepaid freight. Invoices will come to us marked "Prepaid freight on shipment of such and such a date," with no mention of what the shipment consists or what order it is shipped on; the bill of lading will merely state "box of drill parts (or groceries)." It is often necessary to detach these bills of lading from the invoices for presentation to an agent or for forwarding to a traffic man for some claim adjustment or investigation.

The first difficulty arises in the proper identification of these bills of lading with their orders, and then the receiver must be careful to put his own identifying data on them or he will have further trouble when the bills of lading come back. In other words, there are not sufficient data on both bill of lading and invoice so that they can be quickly identified both as to their connection with each other and with their proper orders. In many instances companies have their own printed form of bill of lading, and one may be sure that, on these, they are very careful to have their own order or invoice number; but how many of them are equally considerate of their customers and put the customer's order number on it?

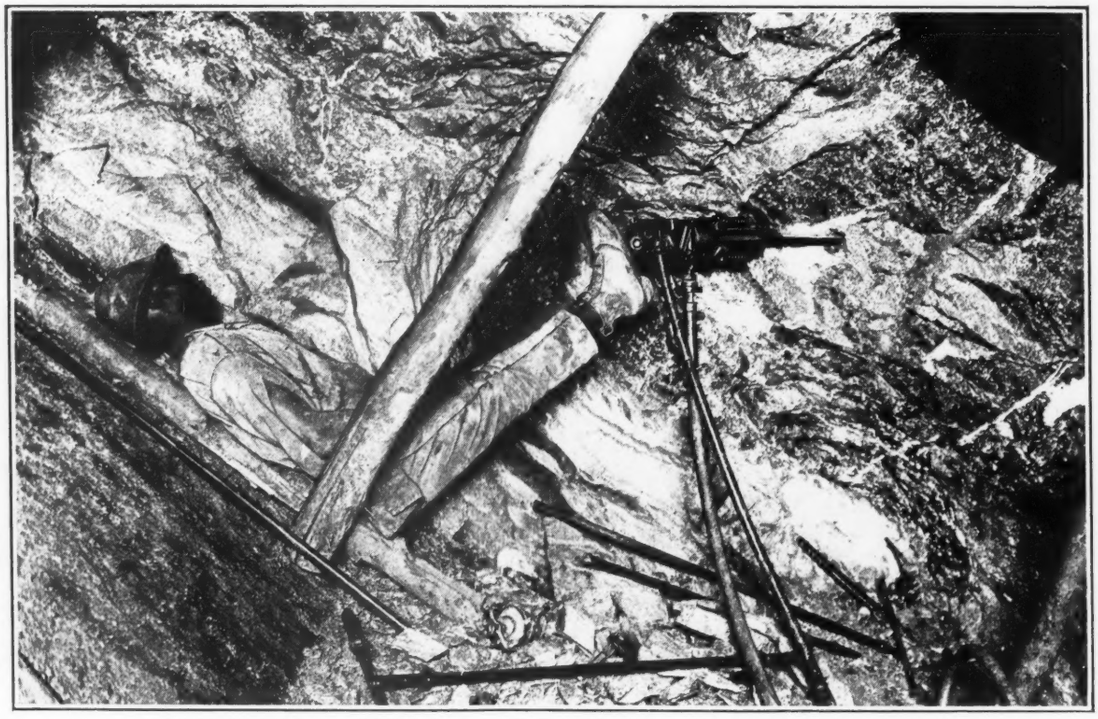
There is also the question of size and style of the bill of lading where the seller has his own printed form. A certain large company with branches all over the country appears to have a great variety of styles and sizes of these bills of lading printed on different kinds of paper and in different colors; it would seem that this particular company could well afford to standardize on one form and quality of paper, which would effect an economy for the company and most certainly receive the hearty approval of its customers.

Invoices Vary Unnecessarily in Size

Size of Invoices—Here again is a constant source of aggravation to the mine accountant. From the nature of the mining business, it is probably necessary to purchase a wider variety of supplies than in any other business. All sizes, colors, shapes, and kinds of invoices come to us. It is a fairly well-established practice for letters to be written on paper 8½x11 in., and the greater part of all business filing is done in cases arranged to take this size. In spite of this, there are any number of concerns which have their invoice forms wider than 8½ in.—not enough to do any material good, but just enough so that they will not fit in the 8½x11-in. file nor in the 8½-in. wide file, which is most generally used for vouchers, this latter being the usual length of bank checks and vouchers.

Some of the matters mentioned may seem trivial and the reader may think that others are exceptional or exaggerated, or if not exaggerated, at least their importance is magnified unreasonably. Yet it is the small things that count very often, and the loss of a few minutes on an invoice in a small operator's office may mean little; but when one considers the number of offices in which these same few minutes may be lost each day—when one considers that the good will of the customer is often vital to the success of the manufacturer—then it will be apparent that too much stress cannot be laid upon the correction of any difficulties which are a constant irritation to the customer.

A Feat in Drilling on the Rand



This South African gold miner has developed his own method of "taking five" without stopping work

The United Verde Smelter

Local Conditions Make Treatment in Both Blast and Reverberatory Furnaces Advisable—Cottrell Plant a Recent Important Addition

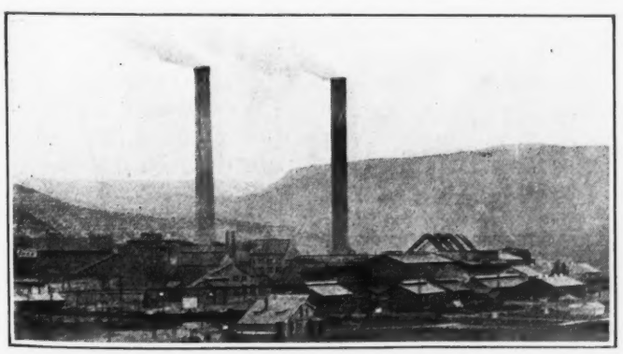
By George J. Young
Associate Editor

THE LOWER PART of a circular water-jacket blast furnace stands in the smelter yard in front of the general offices of the United Verde Copper Co. at Clarkdale, Ariz. On it is a bronze plate bearing the inscription:

"This is one of the two old furnaces found on the Hampton lode United Verde Copper Company mines at Jerome, Arizona. On March 5th, 1888, when I first visited the property, I started operation of this furnace and also the other one on May 22nd, 1888. W. A. CLARK."

The present smelter, which superseded the smelter at Jerome, was started on May 26, 1915. The little furnace on the one hand and the great plant on the other are fitting commentaries of the development of copper mining and smelting in the Southwest and the business acumen of Senator Clark and his associates. A history of absorbing interest could be written of this industrial development so fittingly delimited. However, I shall only attempt to record the recent practice and improvements, as the smelter has been well described by L. A. Parsons.[1] Since Mr. Parsons' article in 1920, several additions have been made: a new crushing plant, a battery of roasters, reverberatories, waste-heat boilers, stack, and a central Cottrell plant have been constructed.

Smelting is conducted in blast furnaces and reverberatories. The matte produced is converted to blister copper and shipped as such. The converter slag is re-treated in the reverberatories. The heavy sulphide ores are crushed to ¼-in. size and roasted in Wedge furnaces. The calcine is smelted in the reverberatories, as is also all of the dust from flues and Cottrell treaters. Blast-furnace ore is crushed to 3-in. size before smelting. The general flow sheet of the plant, which supplements the flow sheet given in the article on the



Roaster building (to the left) and coal-pulverizing plant

United Verde crushing plant (*E. & M. J.-P.*, March 8, 1924, p. 396) is given in Fig. 1. Supplementing this I have sketched a diagrammatic balance sheet (Fig. 2), indicating the disposition of a day's weight of copper and the larger metallurgical losses.

Apart from the metallurgical practice which will be discussed, the plant as a whole affords an interesting study in the handling of relatively large weights of material with a minimum of labor. The smelter crew totals 375 men. The ore received per day is 3,500 tons, from which is produced about 8,000,000 lb. of copper per month. In addition there is required each day 175 tons of limestone, 85 tons of coke, and 300 tons of coal. This incoming material and fuel, exclusive of oil, totals 4,060 tons. Intermediate products which are transferred from one operation to another consist of 3,500

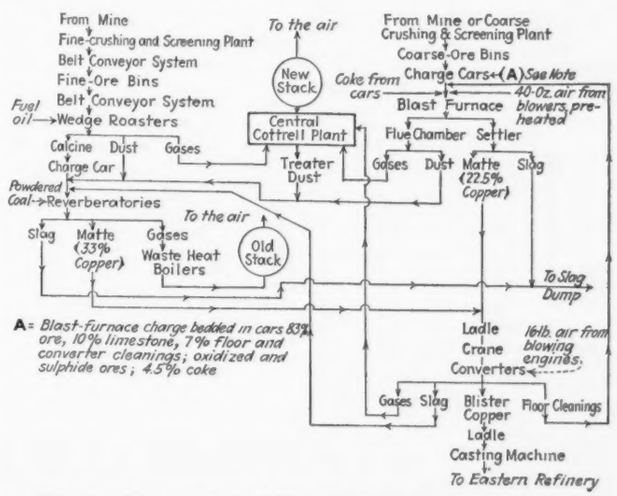


Fig. 1—Flow sheet of the Clarkdale smelter, United Verde Copper Co.

Ore tonnage, 3,500 tons daily (700 tons for each operating furnace)
Men employed: Crushing plant and smelter, 375; power, shops, foundry, and other, 150
Wedge roasters: 12 six hearths, 21.5 ft. diameter; 12 seven hearths, 22.5 ft. diameter
Reverberatories: 3, 19 by 100 ft.; 3, 25 by 101 ft.
Blast furnaces: 4, 48 in. by 26 ft.; 48, 4.75 in. tuyeres
Converters: 8, 12 ft. diameter, Great Falls type
Casting machines: 2 straight-line type
Boilers: Stirling, 12, 700 hp.
Cottrell Treater: 4 batteries in parallel
Old stack: steel, self-supporting, brick-lined, 400 by 30 ft.
New stack: brick, 430 by 29 ft.
Roaster dust chamber: 140 ft. by 50 ft. by 21 ft.
Blast furnace and converter dust chamber: 220 ft. by 59 ft. by 29.5 ft.

tons of ore through the crushing plant; calcines, 1,475 tons; flue and treated dust, 122 tons; siliceous ore to converters, 200 tons; matte from blast furnaces and reverberatories, 580 tons, and converter slag, 500 tons, or a total of 6,377 tons. Of the final products the slag moved to the dump approximates 2,440 tons and the copper loaded into cars 135 tons, a total of 2,575 tons. The total tonnage therefore approximates 13,012 tons, or about 35 tons per man per day. On the basis of ore received the ratio is 9.3 tons per man per day. The total power used per day with three reverberatories and two blast furnaces in operation, including boiler room and power-house accessories, shops and heating system, is 21.5 boiler horsepower hours in steam generated at the plant, and 1,434 kilowatt-hours per ton of ore.

The mine ore is delivered from the Hopewell tunnel

[1] "The United Verde Smelter," *Mining and Scientific Press*, Oct. 16, 1920, Vol. 121, p. 547.

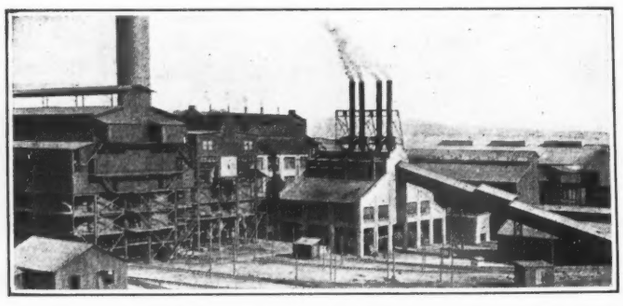
Smelter office building at Clarkdale

to steel bins and transferred to 75-ton steel cars, in which it is hauled on the Verde Tunnel & Smelter R.R. 6.7 miles to the smelter at Clarkdale, which is 940 ft. lower in altitude than the Hopewell adit. It is dumped into the receiving bins of the crushing plant or into the coarse-ore bins of the smelter.

The crushing plant delivers by a conveyor system a coarse product to the coarse-ore bins or a ¼-in. product to the fine-ore bins. The coarse-ore bins discharge into weighing hoppers and these in turn discharge into Anaconda-type blast-furnace charging cars, which are hauled by electric locomotives to the blast furnaces. The fine ore is delivered to the roasters by a system of conveyors. From the roasters the calcine is hauled by electric locomotives to the feed hoppers of the reverberatories.

Slag from the reverberatories and blast furnaces is received in 225-cu.ft. motor-tilted slag pots and hauled by electric locomotive to the slag dump. Flue dust and treater dust is discharged by hoppers into calcine cars and hauled by electric locomotive to the reverberatories. Reverberatory matte is discharged by short runners into a ladle mounted on a special truck on a track in a tunnel between each pair of furnaces. The truck and ladle are hauled out by a hoist to the converter aisle and the ladle is picked up by the converter crane. The blast-furnace matte is discharged by a short runner to ladles in the converter aisle.

All tracks are standard gage; the grade is in favor of loads generally, and the trackage is interconnected. There are two main slag tracks, from one of which each blast furnace is served by short spurs. Two slag pots are set at each blast-furnace forehearth. No spurs are provided at the reverberatories. The slag tracks connect with a loop which extends around the circular slag dump. The flue-dust track extends from the blast-furnace dust chamber to the Cottrell treaters and roaster dust chamber to the reverberatory charging track. A 150-ton track scale is placed on the main incoming track, and 40-ton and 75-ton track scales are placed on the reverberatory charging tracks handling calcines from the roasters, and flue and treater dust. Weightometers are used in the crushing plant and platform scales at the copper-casting machines for weighing the copper. There is thus an accurate weighing of incoming and charged materials and of the final product as well as flue and treater dust. Intermediate products, matte and converter slag and final slag, are estimated.



General view of smelter

The coarse- and fine-crushing plants and stockpile provide 79,950 tons and the coarse- and fine-ore bins 24,000 tons storage of ore and limestone. The fuel storage is 12,000 tons of coal, 3,000 tons of coke, 20,000 bbl. of fuel oil, and 600 tons of Diesel oil.

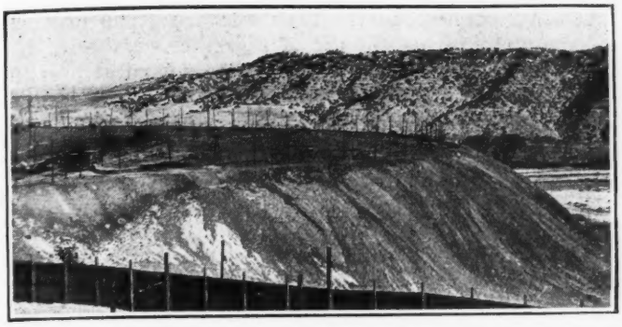
The plant site slopes to the southeast and decreases in elevation about 85 ft. in 1,800 ft., the approximate extent of the plant in this direction, and it is simply and compactly arranged. The converter aisle is 660 ft. long by 60 ft. in width. The blast furnaces are end to end and the reverberatories side by side at a level above the converter floor and on one side of the converter aisle. This gives the least transfer distance for handling the matte to the converters. The converters are arranged in a row on the side of the converter aisle away from the furnaces. At each end of this row a casting machine is placed. The casting machines deliver the quenched slabs to the floor of the casting shed, whence they are trucked to the scales and to the cars on the loading track. The skull breaker is near one end of the converter aisle, the other end being used for repairing and relining converters. At this end, outside of the aisle, the refractory materials are stored in a shed and a crusher and mud mill are available for mixing.

The coal-pulverizing plant is between the two groups of roasters and the reverberatories. The power house, 60x450 ft., is parallel to the converter aisle and in line with the machine shop and foundry. The smelting and roasting furnaces and converters are so placed as to admit of short straight flue runs to the dust chambers and the two stacks. By a system of dampers either stack can be used for the gases from the roasters, blast furnaces, and converters. The reverberatory gases are wasted through the old stack, 400x30 ft. The new stack, 430x29 ft., is of brick construction and is connected to the outlet flue of the Cottrell treater which receives the gases from the roasters, blast furnaces, and converters. The crushing plant, stockpiles, and smelter bins are between the receiving tracks and the roasters.

Metallurgical Practice

The ore is divided into four classes: oxidized ore from the steam-shovel pits, massive sulphide ore from underground containing 15 per cent or less silica, schist ore containing more than 15 per cent and less than 50 per cent silica, and converter ore which is low in copper and high in silica. In addition, a relatively small amount of precipitate from the precipitating troughs at the Hopewell tunnel is treated. Although the foregoing division is more or less held to, the ores are to a considerable extent divided in two groups, coarse ore and fines from the steam-shovel operations. The analyses of these two types are given in Table I.

The total tonnage per day, 3,500 tons, is divided between coarse and fines in the proportions required for



Circular slag dump

smelter operation. During October, 1923, the blast furnaces handled 66,762 tons of charge, consisting of 54,128 tons of sulphide ore, 700 tons of siliceous ores, 650 tons of matte, 6,942 tons of limestone, 4,314 tons of chips and sweepings, and 28 tons of precipitate.

Table I—Approximate Analyses of Coarse and Fine Ore

	Coarse Ore, Per Cent	Fine Ore, Per Cent
Copper	5.5	4.8
Silver, oz. per ton	1.84	2.95
Gold, oz. per ton	0.05	0.07
"Insoluble"	23.0	28.0
Silica	21.2	26.0
Iron	28.6	25.6
Alumina	4.6	6.7
Sulphur	27.3	21.8
Zinc	1.7	1.5
Lime	1.1	1.0

The average per furnace day was 718 tons (eight tons per square foot hearth area) and 4.7 per cent of coke was required. For the same period the roasters handled 36,614 tons of sulphide ore and 750 tons of siliceous ore, a total of 37,364 tons. The roasters averaged 87 tons per furnace day and required 1.02 gal. of fuel oil per ton. The reverberatories received 31,660 tons of calcine, 1,803 tons of blast-furnace and converter dust, 230 tons of roaster dust and 1,279 tons of treater dust, or a total of 34,972 tons. The average per furnace day was 565 tons, 20 per cent of coal being required.

The composition of the blast-furnace charge and slag is given in Table II.

Table II—Analyses of Blast-furnace Charge and Slag

	Charge, Per Cent	Slag, Per Cent
Silica	20	35
Iron	25	(FeO) 39
Alumina	4	7
Sulphur	22	
Lime	7	11
Zinc	1.5	2
Copper	5	0.3

The blast-furnace matte averages 22.5 per cent copper. The blast furnaces are equipped with Giroux tops, and the air is preheated to an average of 70 deg. F. above normal. The height of charge varies from 10 to 14 ft. Blast air averages 70,000 cu.ft. per ton of charge (3,500 ft. altitude). The charge consists of 10 per cent limestone (lime 51 to 52 per cent), 7 per cent chips and converter cleanings, and 83 per cent ore. Thirty tons, bedded in the charge, is charged at one time, the coke being first charged from buggies. It is of interest to note that the proportion of coke has been gradually reduced from 6.1 per cent in 1920 to 4.5 per cent in 1923. It is expected that the coke can be reduced further to 3.5 per cent of the charge. Experiments indicate that by the use of well-screened ore of proper analysis the blast furnaces average better than 850 tons per furnace day on 40-oz. blast pressure. With inferior screening and mixing the tonnage falls to 700 and the coke requirement is increased. The separation of smelting ore into coarse and fine and the treatment of the one in blast furnaces and the other in reverberatories is of interest.

The sulphur in the roaster feed is reduced from 20 to 24 per cent to from 8 to 9 per cent. Where the sulphur is 24 per cent, or better, extraneous fuel (oil) is required only for remedying some local furnace conditions, and averages 0.25 gal. per ton providing the charge does not exceed 70 to 75 tons per furnace day. Forcing the tonnage up to 110 tons per furnace day increases the oil consumption to 3 or 4 gal. per ton. At 70 to 75 tons per furnace day and 21 per cent sulphur the oil consumption increases to 1 gal. per ton.

Normal roasting cost is 20c. per ton, but this is increased with lower or higher feed rates. A conspicuous feature of the roasting is the slow speed at which the rabbling is done, the shaft making one revolution in 1 min., 53 sec. No advantage has been obtained by doubling or tripling this speed, but, on the contrary, power and repair costs were increased. The ore is hard and compact, and therefore roasts slowly. It must be crushed fine to insure a sufficient reduction in sulphur content.

The analyses of reverberatory ore charge and slag are given in Table III.

Table III—Approximate Analyses of Reverberatory Solid Charge and Slag

	Charge, Per Cent	Slag, Per Cent
Copper	5.8	0.4
Silica	27.0	34.0
Iron	36.5	(FeO) 46.0
Alumina	7.7	8.0
Lime	1.4	2.0
Zinc	2.0	2.0

The reverberatory matte averages 33 per cent copper. Intermittent skimming is practiced, owing to the absence of spur tracks at each furnace. An exceptionally long life has been obtained from the reverberatories as a result of massive construction and the use of an arch of 20-in. silica brick over the whole furnace length. One furnace has been operated for twenty-nine months

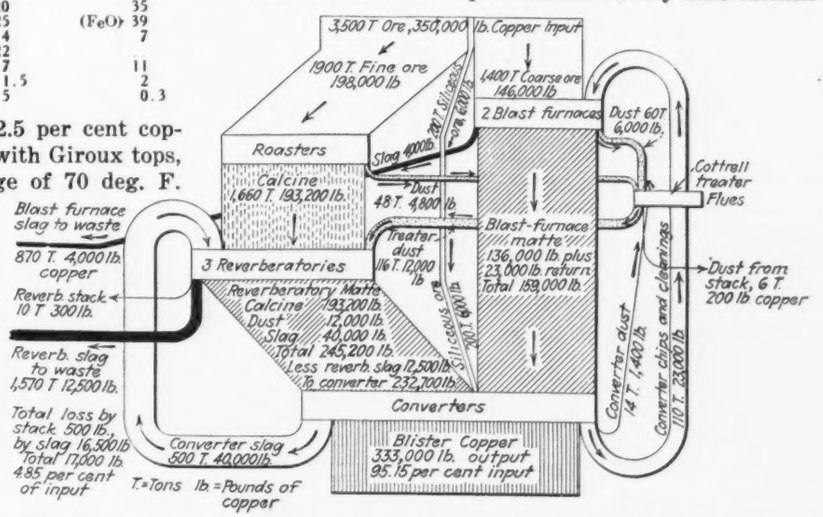
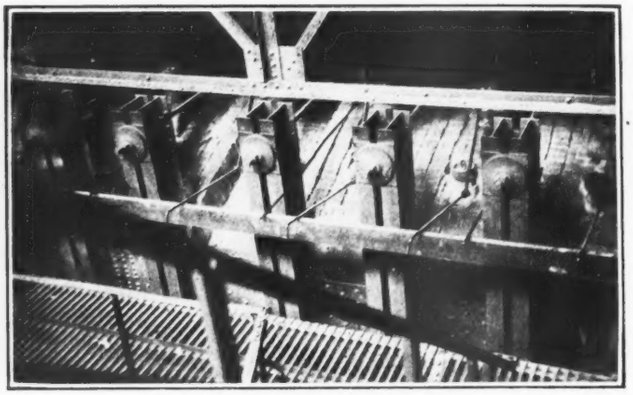

3,500 T Ore, 350,000 lb. Copper Input
1900 T. Fine ore 198,000 lb
1,400 T Coarse ore 146,000 lb
200 T. Siliceous ore 6,200 lb
2 Blast furnaces
Dust 60 T 4,000 lb.
Roasters
Slag 4000 lb
Calcine 1,660 T. 193,200 lb.
Dust 48 T. 4,800 lb
Cottrell treater Flues
Blast-furnace matte 136,000 lb. plus 23,000 lb. return Total 159,000 lb.
Treater dust 116 T. 12,000 lb
Blast furnace slag to waste
870 T. 4,000 lb. copper
3 Reverberatories
Reverb. stack 10 T 300 lb.
Reverberatory Matte 193,200 lb.
Calcine 12,000 lb.
Dust 40,000 lb.
Slag Total 245,200 lb.
Less reverb. slag 12,500 lb.
To converter 232,700 lb.
Dust from stack, 6 T. 200 lb copper
Reverb. slag to waste 1,570 T 12,500 lb.
Converters
Converter dust 14 T. 1,400 lb.
Converter chips and cleanings 110 T. 23,000 lb.
Total loss by stack 500 lb., by slag 16,500 lb Total 17,000 lb. 4.85 per cent of input
Converter slag 500 T. 40,000 lb
Blister Copper 333,000 lb. output 95.15 per cent input
T.=Tons lb.=Pounds of copper

Fig. 2—Daily graphic balance sheet, showing disposal of smelter feed and product. Width of band is proportional to weight of contained copper



Method of supporting and building reverberatory-furnace arches

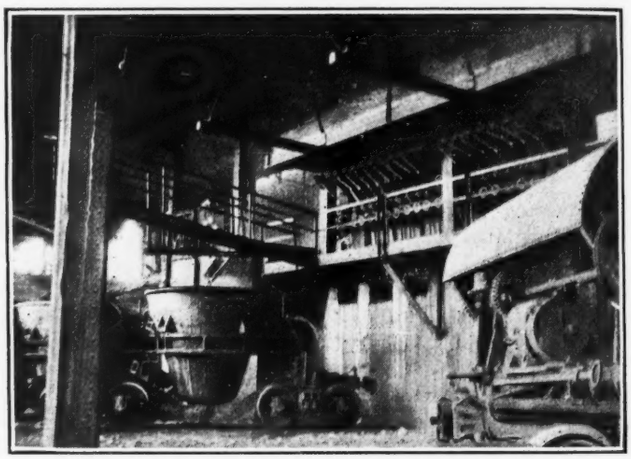
without roof repairs. Each reverberatory supplies two waste-heat boilers. The overhead connecting flues are cleaned daily, and to avoid the additional expense required by frequent cleaning and the loss of heat, plans are under consideration to move the boilers closer to the furnaces, as is the practice in later plants. It is expected by this change to reduce the cleaning by one-third and to increase the steam by 10 per cent.

The availability of six reverberatories and four blast furnaces makes an interesting smelting arrangement. At the time I visited the plant three blast furnaces and two reverberatories were in operation. As the blast-furnace matte contains about 22 per cent of copper, the volume of converter slag resulting is excessive, particularly when it is cleaned in the reverberatories that are smelting ore. The volume of converter slag resulting from reverberatory matte which carries 33 per cent copper is considerably less. Under these conditions the reverberatories handled 550 tons of charge per furnace day and averaged 20 per cent fuel. When one blast furnace and two reverberatories were operated, the reverberatory output was increased to 625 tons per furnace day and the coal averaged 17 per cent. The normal capacity of the twenty-four roasters is 1,800 tons per day, or somewhat greater than sufficient to supply three reverberatories. The present roasting capacity thus limits the number of reverberatories that can be used and necessitates the use of a greater number of blast furnaces than would otherwise be desirable with the existing daily tonnage.

Trinidad coke, which is used in the blast furnaces, costs $15 per ton, and at 4.5 per cent on the charge the fuel cost of blast-furnace smelting is $0.675 per ton of charge. Coal from Gallup, N. M., costs $5.25 per ton and when pulverized $6 per ton. Fuel oil from California costs $2 per bbl. The reverberatory fuel costs $1.25 per ton of charge and oil fuel for roasting about 5c. per ton. The approximate fuel cost of reverberatory smelting is $1.30 per ton of charge, not allowing credit for waste heat recovered. There is thus a small advantage in lower fuel cost for blast-furnace smelting. The copper content of the blast-furnace slag is lower, which gives a further advantage to blast-furnace smelting. However, the power requirements of the smelter necessitate the use of the waste heat from the reverberatories, and fine ore can be best smelted in reverberatories. Use of reverberatory matte reduces the amount of smelting in the converter and the volume of converter slag. Thus the reverberatory with its accessory roasters advances the process of reduction further than the blast furnace. The practice of the plant favors the use of a greater number of reverberatories and fewer blast furnaces than at present in operation. The availability of fine-crushing equipment may result in an interesting adjustment between blast-furnace and reverberatory smelting, the outcome of which will be viewed with interest.

Treatment of Waste Furnace Gases

Blast and reverberatory smelting and converting follow closely established practice and need not be further described. The handling of the furnace gases is of interest. The reverberatory gases are collected by a main flue and discharged through a brick-lined steel stack. The blast-furnace and converter gases are received in a dust chamber 30x59x220 ft. under which are two tracks for relieving the hoppers of their contents. A separate flue connects the dust chamber with the inlet flue of the Cottrell treater plant. The roaster gases are received into a 21x50x140-ft. dust chamber



Blast-furnace slag pots and lower portion of the furnaces

which also connects by a flue to the inlet of the treater plant. Four treater batteries are arranged in parallel between the inlet and outlet flues. The outlet flue connects with a brick stack. Two treater batteries consist each of six units containing each 120 twelve-inch pipes, 16 ft. in length. The gases are introduced at the top and flow downward through the pipes, thus equalizing the flow between the pipes. The discharge electrode is a small chain.

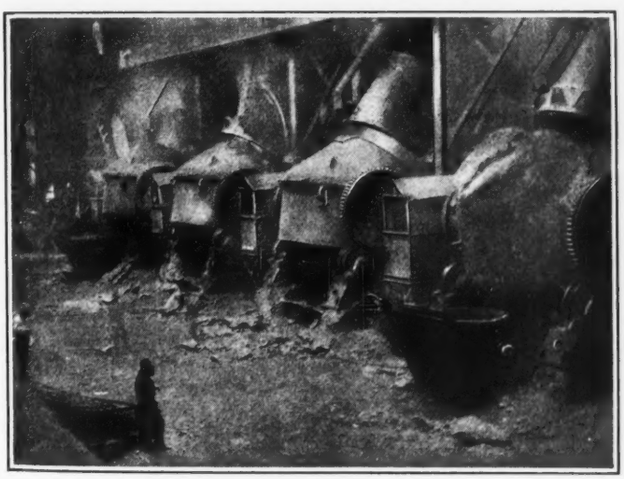
Each battery has a capacity of 200,000 cu.ft. per minute. The third battery is of the plate type, patterned after the treater used at the International smelter, at Tooele, Utah. Vertical plates of corrugated steel, 9-in. centers, are placed parallel to the gas flow. The plates are receiving elements and are grounded. The discharge electrodes are $\frac{3}{8}$ in. square twisted steel rods running longitudinally and spaced 6 in. apart in a vertical plane between each pair of receiving electrodes. This battery has a capacity of 200,000 cu.ft. The fourth battery is of the transverse pervious electrode type. The receiving electrodes are $\frac{1}{4}$-in. pipe, 2 in. apart in a vertical plane at right angles to the gas flow, the successive sets of electrodes being 9 in. apart. The discharge electrodes are $\frac{1}{4}$-in. square twisted steel bars arranged horizontally 6 in. apart in a vertical plane at right angles to the gas flow.

The arrangement of the separate treater batteries

is such as to admit of the three types being used in parallel, or by the use of dampers any battery can be cut out. The current is supplied from a separate building close to the treaters. The motor generators, exciters, rectifiers, and switchboard are on the second floor of the fireproof building. The transformers are placed on the first floor. This arrangement is a good one, as the high-tension wiring is between the top of the transformer and the ceiling of the lower floor. The high-tension leads extend from the rectifiers directly to the bus leading to the treaters. The rectifiers and transformers are guarded by grounded wire mesh partitions.

The average voltage maintained on the treaters ranges from 50,000 to 75,000 volts. The power requirement is 3,900 kw.-hr. per day. Inlet gas temperature is 400 deg. F. and outlet temperature 300 deg. F. The velocity of the gases through the treaters is about 6 ft. per second. Treater dust averages 30 to 40 tons per day and the dust from the dust chambers and treater inlet flues averages about 70 tons per day. These dust recoveries refer to the period before Jan. 1, 1924.

The treater plant was designed for the use of the maximum number of reverberatories and the minimum number of blast furnaces, a condition which can now be obtained with the new crushing plant in operation. Although each treater was designed to handle 200,000 cu.ft. of gas per minute, it was found that in treating roaster gases, this volume could be exceeded by at least 25 per cent, with a recovery of over 90 per cent of the dust. In treating blast-furnace and converter gases



Great Falls type converter in operation

the capacity of the individual treaters for similar recovery is less. The present (latter part of 1923) volume of gas treated is about 900,000 cu.ft. per minute.

The greatest item of replacement is in parts of the rapping devices. Lower grid insulators in the pipe treaters and rotating shoes on the rectifier disks also require replacement at intervals. One repair man and helper are on the day shift and one power-house operator and one treater operator are on each shift. Once a month a chemist from the testing department measures the volumes of gas passing through each treater and determines the dust losses.

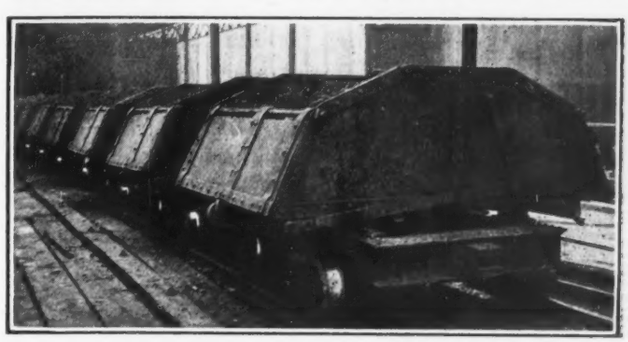
Coal is stored in stockpiles and is handled by a traveling gantry over the stockpile, and from bins beneath the receiving track. From these it is discharged upon a belt conveyor and sent through a breaker and then by conveyor belt to two Ruggles-Coles driers. It is conveyed to two Jeffrey disintegrators and then by bucket elevator to the bins in the pulverizing house. Eight Raymond roller mills with suction discharge reduce the coal to dust. The coal dust is distributed by screw conveyors to 60-ton bins above the burner ends of the reverberatories. Each reverberatory is equipped with five coal-dust burners.

Two power sources are available, the steam from the waste-heat boilers and the electric power supplied by the Arizona Power Co. Electric power is used generally throughout the plant, two Allis-Chalmers turbo-generators, one 1,500 and the other 2,000 kw., supplying the power circuits. A third turbo-generator of 6,000-kw. capacity will be installed in the near future. Blast-furnace air is supplied by three Root blowers, two No. 11 and one No. 9½, all driven by motors. Two additional No. 11 Root blowers are provided, one driven by a Corliss engine and the other connected by a rope drive to a pair of vertical Diesel engines. The Diesel blower unit is used in emergencies. Converter air is supplied at 16 lb. pressure by two Nordbergs and a Southwark blowing engine, the three units aggregating 64,000 cu.ft. of free air per minute. A 20,000-cu.ft. Allis-Chalmers blowing engine has been recently installed. The air cylinders are 54 in. in diameter, the steam cylinders 25 and 52 in., and the stroke is 48 in. Air and circulating pumps and condensers complete the steam installation.

A cooling pond is used to conserve condenser water. High-pressure air for general use is supplied by a two-stage Ingersoll Rand 2,470-cu.ft. compressor driven by a synchronous motor and a two-stage Nordberg steam-driven compressor. Direct current for operation of trolley circuits is supplied by two Westinghouse 200-kw. motor-generator sets. A small turbo-generator supplies 440-volt alternating current in emergencies. The power house is served by a 20-ton traveling crane.

All outside power circuits are underground, and inside wiring is in conduits. Duplicate power lines are extended to important circuits. Water is supplied by natural springs augmented by a pumping plant on the Verde River. The shops, which are grouped close to the general warehouse, are the machine shop and foundry, the blacksmith shop, boiler shop, carpenter shop, and welding shop. An assaying and chemical laboratory, general office, and a change house are provided.

R. E. Tally is general manager of the United Verde Copper Co. Tom Taylor is general superintendent of the plant, and C. R. Kuzell is smelter superintendent. Both Mr. Taylor and Mr. Kuzell, in the absence of Mr. Tally, extended the courtesies of the plant to me. The liberal policy of the company is especially commendable.



Blast-furnace charge cars

Discussion

"The Crisis in Copper"

THE EDITOR:

Sir—I have just read with interest your editorial in the July 5 edition of *Mining Journal-Press* entitled "The Crisis in Copper." Since you do not speak of a factor recently reported by the U. S. Geological Survey—namely, the amount of secondary copper recovered in 1923—I wish to ask if it is not a matter of significance.

The Survey reports that in 1923 more than 410,000 tons of secondary copper was recovered from new and old scrap. This is in excess of 800,000,000 lb., which is somewhat more than half the total mine production in the United States for the same year. It is also more than half the increased rate of mine production for 1924 noted by Mr. Wormser in his article on page 374 of the issue cited.

Moreover, the amount recovered in 1923 was a third greater than the amount recovered in 1922. And at that time we were told that the amount recovered, which was heretofore unprecedented, was due to the salvage of war materials. It now looks, however, as if the salvaging of war materials had developed new facilities for the recovery of secondary copper from scrap in normal times, and created a new source of supply that is of very great importance permanently. Your opinion on this question will be of great interest.

I surmise that there are no statistics of the current recovery of secondary copper, and that we do not know therefore how much has been turned back into the market from this source so far in 1924. But if copper is being recovered and turned back into the market at a rate at all comparable with that of 1923, it is difficult to see how the United States mines can effectively control the market without reducing their output by half. Such reduction, I take it, would mean for many going out of business.

It is also pertinent to raise the question how a tariff upon imports of copper can be of any great help to the copper mines if half of their own production can yearly be brought back into the market in competition with them. It does not look like a legislative problem, but an economic one. C. B. HAMMOND.

New Haven, Conn.

"Away With the Gold Standard?"

THE EDITOR:

Sir—In your issue of June 21, 1924, W. de L. Benedict questions my statement that "It is no use pretending we are working on the basis of any international gold parity when the dollar, the pound, the franc and the lira alter their relationship every couple of hours."

I am not alone in my contention. John Maynard Keynes, in his "Monetary Reform," states as follows:

"When the currencies of the world were nearly all on a gold basis, their relative value (i.e., the exchanges) depended on the actual amount of gold metal in a unit of each, with minor adjustments for the cost of transferring the metal from place to place.

"When this common measure has ceased to be effective and we have instead a number of independent systems of inconvertible paper, what basic fact determines the rates at which units of the different currencies exchange for one another?"

Foster and Catchings, whose text is "confusion is better than chaos," in their very brilliant apology for the gold standard, entitled "Money," write:

"As soon as the greater part of Europe abandoned the gold basis, the confusion was such that all price and wage comparison became misleading. In February, 1921, for example, the wages of carpenters, in gold exchange value, were about as follows: in the United States $9 per day; in Great Britain $3.26; in Belgium $1.91; in China $0.30; in Germany $0.24."

Mr. Benedict's historical review of the relationship established by law between various national units is most interesting. There is no question that the operation was successful. But the patients are dead. He is dealing with units *de jure*. I refer to units *de facto*.

Mr. Benedict contends that the pound sterling contains 113.0016 grains of fine gold and has not changed in 108 years. My reply to this is that I am willing to sell him, on this basis, an order on London for £1,000 *sterling*, indorsed by a reputable bank, *and allow him five per cent discount*. This offer, perhaps, belongs more properly in your very useful Searchlight Section.

San Francisco, Calif. DAVID ATKINS.

Carbonaceous Gold Ore Treatment

THE EDITOR:

Sir—In the *Mining Journal-Press* of May 31, 1924, an article, "Carbonaceous Gold Ore Treatment," contains the following statement: "Increased knowledge in colloidal chemistry prompts the suggestion that such abstraction of gold by carbon is an adsorption phenomenon, and that its re-solution is due to a disturbance of surface-tension equilibria."

Experiments made at the Rare and Precious Metals Station of the U. S. Bureau of Mines at Reno, Nev., the results of which have been submitted to the American Institute of Mining and Metallurgical Engineers, showed that the abstraction of both gold and silver from cyanide solutions by means of charcoal or carbon (not graphite) is an adsorption, but not a simple adsorption of the alkaline auro- or argento-cyanide.

Using $KAuCy_2$ as an illustration for this, the investigation showed that:

1. The K was not adsorbed, but remained in solution as $KHCO_3$.

2. The $AuCy_2$ was adsorbed, not as $AuCy_3$, but as a double salt.

These facts indicate a double decomposition involving the original salt in solution and some substance in the charcoal. With pine charcoal, this appeared to be CaO and with a pure charcoal (sugar charcoal) appeared to be H_2O. These facts also indicate the necessity of the presence of CO_2 in some form in the charcoal. The final results may be formulated as follows:

For pine charcoal: $2KAuCy_2 + CaO + 2CO_2 + H_2O \rightarrow Ca(AuCy_2)_2 + 2KHCO_3$

For sugar charcoal: $2KAuCy_2 + H_2O + 2CO_2 + H_2O \rightarrow 2HAuCy_2 + 2KHCO_3$

In these the first product is adsorbed and the second remains in solution.

No evidence was obtained that a change of surface tension was always accompanied by the same effect. In some cases the re-solution of the gold or silver salt by different substances was accompanied by an increase of surface tension and in others by a decrease. It is well known that an adsorbable substance will, if given the opportunity, replace to some extent another substance already adsorbed. In this way adsorbed alkaline auro-cyanide can be partly removed by the subsequent adsorption of alkaline argento-cyanide, or vice versa. It would appear that the removal of gold from charcoal by means of a soluble sulphide is a disadsorption of the gold salt due to the adsorption of the sulphide. Other substances that were found to remove the adsorbed gold or silver salt in varying degrees were hot water, alkaline hydroxides, and alkaline cyanides; the latter being especially active when hot. Sodium sulphide, a strong solvent for the adsorbed gold salt, does not remove the adsorbed silver salt, while mercurous nitrate, a strong solvent for the adsorbed silver salt, does not remove the adsorbed gold salt.

Adsorption is extremely rapid and takes place even without regular agitation. There is a lag in charcoal adsorption with alkaline auro- or argento-cyanide which is readily explainable by the time required for the action to reach the less accessible pores. It is perfectly true that "although early contact with cyanide solutions may facilitate the solution of the gold, it also facilitates premature precipitation." If a carbon is present in the ore capable of adsorbing the gold or silver, this action will be so rapid that the damage is done before any steps can be taken to prevent or ameliorate it. Once adsorbed, the force holding the adsorbed salt in the charcoal or carbon is so strong that the salt is removed with difficulty, and, apparently, never entirely, so there is no question in this case that "prevention is usually better than cure." JOHN GROSS.

Washington, D. C.

The Engineer's Responsibility

THE EDITOR:

Sir—Financing or promoting an industry is a difficult job, so difficult that many promotions die before they get on their feet. It is not possible to insure ability and energy. It is common for promotors to be met with the offer "We'll finance it for the control, or we will buy your invention, or property, but we will not hand our money over to you and your officers to spend for us." Such an offer is a strong recommendation for the project, but indicates a lack of confidence in ability. Thus capitalists are often willing to back the project with their money and their own ability, when unwilling to back it with their money and the promotor's ability.

Ambitious promotors often visualize a possibility for great profit. Their vision and their honesty may be unquestionable, but their knowledge of the details may be nil. They "get up a company," sell stock, and elect themselves to the positions of handling the money, and fail. Nowhere is this condition more apparent than in the mining business:

An engineer is hired to make a report upon the property, which, if favorable, the promotors show to prospective investors for the sake of selling stock. These promoters and self-elected officers select equipment by observations of what neighboring mines use, and dig away till their money is gone. "A good mine makes a good manager" appears to be the theory upon which they proceed.

It is a radical abuse of an engineer's report to use it as a means of securing funds which are to be squandered under incompetent management. Naturally, the promotor crawls from under by laying the blame on the engineer, and the investor who parted with his money because of the confidence he had in the engineer's report, does the same. How can the engineer protect himself from a blame that should not rest on his shoulders?

Some years ago a man proposed to an engineer a company, organized, officered, and ready to go. The company owned a mine. It was idle. They had several good reports, and, according to descriptions, drawings and photographs in these reports it was, or had been, a real mine. It had had several superintendents; each had produced several millions while in charge, which aggregated about $11,000,000, with the greatest depth 400 ft., and many veins untouched and good ore in every face, a ten-stamp mill, etc. He wanted to sell $100,000 worth of stock to reopen the mine, which was idle, full of water, but with enough low-grade on the dump to return the $100,000. His great argument was that he had secured the former superintendent under whose administration $4,000,000 of the production had been made, to manage it.

There was reason to believe that within moderate limitations the property was a good one. But the engineer, who was a man of long experience and mature judgment, asked him:

"If I advise my friends to furnish this money to you, who is going to spend the money?" The reply was: "Mr. Jones, who has a sixth interest in the mine and who was its former superintendent."

"And you expect me," said the engineer, "to ask my friends to turn over $100,000 for Mr. Jones to spend, who has taken out $4,000,000 and has left you broke, who is fifty-six years old, a practical miner, who was a boot and shoe merchant in Missouri until he was forty, and who is not educated as an engineer? Whose education is probably only a common school education and a business experience in the boot and shoe business which failed? Who failed as a mine manager after producing $4,000,000?"

This man has been carrying "good reports by four engineers" for the last five years, shaking out a little money here and there from small investors, but with no possible chance of getting enough to get the mine in condition to return a dollar. Who is going to get the blame, the engineers who have made the "good reports," or Jones, or the promotor of the incompetently financed and directed enterprise? The investor will lay the blame at the door of the engineer, in whose report he had confidence.

Engineers are accused of being "too conservative" and of "being afraid of their reputation" to such an extent that they will not give a "prospect a chance." If it comes to the question of turning over our friends' money to men who have failed in the boot and shoe business, for them to try their luck as mine managers, I think we had better plead guilty to conservatism. For my part I'm willing to give the prospect "a chance," if the investor who parts with his money has "a chance" too. LETSON BALLIET.

Oakland, Calif.

News of the Week

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Summary

THE CALUMET & HECLA'S railroad contract has been awarded to a Chicago firm for early construction.

Curtailment by zinc producers in the Joplin-Miami field has been disappointing.

The Federal Mining & Smelting Co. has abandoned the Dome Mountain and Duthie mine operations.

Dr. C. M. Carson has been appointed acting president of the Michigan College of Mines.

Silver output of Tonopah, Nev., is normal.

The concentrator of the Pacific Coast Borax Co., in Death Valley, Calif., was recently destroyed by fire.

The Mesabi Iron Co., operating in Babbitt, Minn., is waiting for an improved iron-ore market to continue its sintering operations. The plant is in excellent condition.

Colonel J. C. Greenway was named by the Arizona delegation as candidate for Vice-President in the recent Democratic National Convention.

Director Bain, of the U. S. Bureau of Mines, finds that burdensome taxation is holding back mining expansion throughout the world.

Silver research work has been transferred to the U. S. Bureau of Standards, from the Bureau of Mines.

The Bolco Copper Co. has decreased its holdings in Lower California.

Utah mining camps are maintaining a good shipping record.

Inspiration Consolidated Copper Co. contemplates erecting a large leaching unit.

Inspiration Plans Large Leaching Plant

The Inspiration Consolidated Copper Co. will start at once the construction of a leaching plant that will cost approximately $6,000,000, according to a statement by T. H. O'Brien, general manager. The plant will be at Inspiration, Ariz., and near the present main working shaft. Mr. O'Brien has just returned from a meeting of the board of directors which was held at New York on June 26 and at which time a decision was reached to proceed with the construction. Recent developments of the Inspiration and Live Oak orebodies have added to the company's oxide ore reserves.

The leaching unit will have a capacity of about 7,500 tons per day and will be the largest plant of its kind in the United States. The leaching plant of the New Cornelia Copper Co. at Ajo, Ariz., had a capacity of 5,000 tons per day.

The Inspiration company has just completed the construction of the Porphyry shaft, a large main working shaft that will serve the Live Oak and Porphyry orebodies, and the installation of hoist and shaft equipment is now under way. The large expenditures that have been made by this company for new construction during the last two years, together with the present work about to be started, put the company in the lead over all other copper producers as regards new construction and development during that period.

Fast Drilling in Picher

JOHN PRICE, operating a drill rig on the Anna Beaver Mining Co.'s lands at Picher, Okla., recently drilled a total of 3,045 ft. in thirty days, which is believed to be a district record. The holes were from 220 to 270 ft. in depth.

Michigan Production 48 Per Cent of Pre-war Average

The Michigan copper district is producing approximately only 8 per cent of the present monthly domestic output of 131,000,000 lb. Michigan production is 48 per cent of pre-war average. A large number of shafts are idle, and with the exception of Ahmeek, operating mines are producing not more than 60 per cent of normal. The Calumet & Hecla Consolidated properties are on a five-day week basis. Other copper districts, meanwhile, have been producing at a rate which has served to keep the price per pound below a level at which high-cost mines can operate at a profit.

In the opinion of mining men, there is little prospect of any change in the situation and to make the best of it some of the Michigan mines will strive for lower costs this summer by enlarging underground forces and reducing production cost per pound. Labor is more plentiful than at this time last year, and immigration also is counted on to furnish its quota of experienced men.

Wright-Hargreaves Mill Heads Up to $15

Mill heads at the Wright-Hargreaves mine at Kirkland, Ont., are now running about $15 a ton, which is much higher than the past average. This is due to the rich ore found in the No. 2 vein on the 1,000 level, which has only recently been developed. This vein lies 400 ft. north of No. 1, and the drift has been run 125 ft. and the average assay has been over $50 a ton. The mill is treating 225 tons a day, so that for the present the Wright-Hargreaves is the largest producer in the district. It is expected that some time this year the capacity of the mill will be increased to a rate of about 400 tons a day.

During June the Teck-Hughes produced a little over $89,000. The new main shaft is down 125 ft., and as the permanent equipment is being rapidly installed, faster progress can be expected henceforth.

The Tough-Oakes is encountering its best ore at the lowest level, 1,025 ft. Eighty feet of drifting has been done on ore averaging $15 to $20. The mill will be started in September.

The mill of the Kirkland Lake Gold has been closed and will remain closed pending the results obtained from the extensive development program, which the company has under way. The main shaft, which is at 1,140 ft., will be continued to 1,500 ft., where a large amount of work will be done. The property is being financed by the Anglo-French Exploration Co.

Kansas Mine Inspectors Must Be Qualified

KANSAS is not going to stand for a chief mine inspector who has not proved himself qualified for the position. The supreme court of the state recently handed down a decision declaring that L. Besson, who was recently appointed inspector by Governor Davis, was ineligible for the place because he had been subjected to no examination proving his capability. The court ruled that the work of the state Mine Inspection Department is to save lives and property, and that to do this men with special qualifications must be employed as inspectors.

Following the court decision the Kansas State Industrial Court appointed Ernest Shaw, of Weir City, to be acting State Mine Inspector. It is understood Besson will be given an opportunity of taking the examination at an early date, and, if he passes, will be given the place.

Colonel J. C. Greenway Honored at the Democratic Convention

Although Colonel John C. Greenway, of Arizona, did not roll up a large vote when he was suggested for the Vice-Presidential nomination at the Democratic National Convention, there was enough said in his behalf on that occasion to indicate wide recognition of his ability. Mr. Greenway is one of the engineers who have responded to the call of the profession that more of its numbers interest themselves in politics. He is general manager of the Calumet & Arizona Mining Co. and of the New Cornelia and the Gadsden copper companies and is vice-president of the Tucson, Cornelia & Gila Bend Ry. Before going to Arizona, Mr. Greenway was general superintendent of the Oliver Mining Co., in the Mesaba range in Minnesota. Prior to that time, he was one of the superintendents in charge of mining operations for the U. S. Steel Corporation.

Mr. Greenway came first to national attention during the Spanish-American War, when, as a member of Roosevelt's Rough Riders, he was commended for gallantry in action. As the lieutenant colonel of the 101st Infantry during the World War, he took an important part in the battles at Cantigny, Chateau Thierry, St. Mihiel, Argonne, and of the Meuse. For this service he was awarded the Distinguished Service Cross and various other foreign decorations.

Day Interests Active in British Columbia

Harry Marsh, field engineer for the Day interests, at Wallace, Idaho, has made an examination of the Ibex group, on Texas Creek, a tributary of the Salmon River, in British Columbia. He has let a contract for a tunnel to explore the surface showing at depth.

Mesabi Iron Company Waiting for Better Ore Market

Interests associated with the Mesabi Iron Co. are confident that its iron ore sintering plant at Babbitt, Minn., will be in operation upon a capacity basis during the 1925 season, after a shutdown this year due to iron ore prices having been placed upon an unprofitable basis. It was explained by Dwight E. Woodbridge, of Duluth, mining engineer, who was associated with W. G. Swart, vice-president of the company, that the plant at Babbitt experienced its most satisfactory period of operation during the month of April before it closed down. With a proposed increase in the daily ore tonnage handled by the plant there appeared to be no reason why its operations should not ultimately be placed upon a profitable basis.

The furnace product of the company, known to the trade as Mesabi sinter, comes under the classification of Old Range Bessemer, under which it was entitled to substantial premiums above the base price on account of its grade and purity. As the market in Old Range Bessemer is supplied for the present, the only outlook offered to the company for further 1924 shipments was under the Old Range Non-Bessemer classification without premiums, so that production would have been unprofitable at present prices.

Mr. Woodbridge drew attention to the point that the Mesabi Iron Co. has an almost unlimited tonnage of low-grade ores available, and that it might therefore be regarded as a permanent enterprise. The plant handles ores carrying 30 per cent iron content, and its sinter as shipped carries a content of 64 per cent iron.

The new sintering plant being built by the American Ore Reduction Co. near Crosby, Minn., on the Cuyuna range, is nearing completion. It will handle the ore of the Evergreen state mine, operated by the Inland Steel Co. It will differ from the plant of the Mesabi Iron Co. at Babbitt, in that it will screen the silica from the soft ore to be treated and will then sinter the fines. The plant is scheduled to produce from 300 to 400 tons of sinter daily.

Boleo Copper Decreases Holdings

Following the failure of the American Metals Co. to exercise an option to purchase the Inguaran copper properties, in the State of Michoacan, Mexico, for $1,500,000, the Boleo Copper Co. (known as the Rothschilds interests) has decided to reduce its holdings from 2 802 hectares to 250 hectares, thus avoiding heavy taxation on unproductive denouncements. Though the company announced a profit of 2,928,051 fr. on its Lower California operations for the last year, no dividends were declared and none are in sight, owing to the depressed price of copper. The principal copper properties throughout the country are being effected in the same manner. Cananea is working only about 20 per cent of its men and recently was compelled to discharge several thousand employees.

C. M. Carson Appointed Acting President of Michigan College of Mines

THE board of control of the Michigan College of Mines at Houghton has appointed Dr. C. M. Carson, professor of chemistry at the college since 1913, as acting president until a permanent president is named. He succeeds the late Dr. F. W. McNair, who was killed in a railroad wreck on the Burlington road on June 30.

Dr. Carson was graduated from the University of Toronto with the degree of A.B. in 1898 and from the University of Chicago with the degree of Ph.D. in 1906. He was assistant lecturer at the University of Toronto from 1899 to 1903 and research assistant at the University of Chicago in 1906 and 1907. From 1908 to 1912 he was professor of chemistry at the University of New Brunswick, coming to the Michigan College of Mines in 1913.

Timber Cruisers Spot a Silver Vein

George Harris and R. J. Close, timber cruisers, when working about 100 miles east of Fort William, Ont., discovered an open silver vein, 6 ft. in width and 16 ft. in depth, on the side of a mountain. Samples brought to Fort William are said by experts to be very rich. The vein is thought to be the same as one lost by prospectors fifty years ago and is believed by some to be a continuation on the mainland of the famous Silver Islet vein, which was a heavy producer.

Dome Mines Doing Well

During the month of June the Dome Mines, of Porcupine, Ont., treated 39,080 tons and recovered $360,750, an average of $9.23 a ton, compared with $9.10 in May and $9.04 in April. The total recovery for the first six months of the year was $2,122,980, an average of $353,830 a month, compared with an average of $371,700 for the preceding nine months, but it is believed that production is now increasing again, and as costs are lower during the summer months, the dividend is more than being earned.

East Butte Copper Closes Smelter

Owing to the loss of the Davis-Daly ore, the East Butte Copper Mining Co. has closed its smelter, as production of Pittsmont mine is not at present sufficiently large to enable the company to operate its smelter excepting at a loss. In addition, owing to low prices of copper, the company cannot operate its mine at a profit, and therefore all mining operations at Pittsmont will be discontinued the latter part of this month, pending an improvement in copper quotations.

Mexican Export Taxes Cause Protest

Mining interests in Mexico are jeopardized by the latest Presidential decree requiring the payment of 25 per cent of the value, in gold coinage or substance to be presented at the mint, on all metal exports. At the insistance of the National Mining Chamber, and in response to a large number of protests from mining concerns, the Mexican Secretary of the Treasury suspended the effect of the decree temporarily, so that the opposing interests may be heard.

The mine operators point out that the constantly increasing taxes are wiping out all possible profits. On Jan. 1 of this year a 10 per cent additional tax was decreed to be applied on the public debt. This is an over-all tax on everything, and was followed by a perpendicular raise in railway freight rates, which particularly affected coal and ore shipments, and resulted in the closing of many small mines where ores would not stand shipment. Later came an increased tax on imported steel, an article of heavy consumption in the mines. It is claimed that the latest tax is another increase of 6 per cent. While the evident intention of the government was to ameliorate the financial crisis, and stop the decline of silver, competent authorities insist that it will have no such beneficial effect, but rather threatens to force a crisis in mining operations.

To arrest the present silver depression, the government has ordered the Monetary Commission to step into the gap and buy silver on favorable conditions. It is also expected that a complete cession of silver coinage may be temporarily declared.

Colter and Rickey Win Drilling Contest

Colter and Rickey, representing the Black Eagle Mining Co., won first place in the drilling contest held at Miami, Okla., on July 5, when they took their machine off a platform, set it up, drilled through a six-foot cube of concrete, and replaced it on the platform in three minutes and fifty seconds.

Second place was won by Hoover and Standefer, of the Oko Mining Co., with a time of four minutes twenty-six and two-thirds seconds; and third place to Warner and Skelley, of the Big Elk Mining Co.

Judges and timekeepers included W. T. Landrum, Henry Geissing, George Potter, J. W. Gilbert, and Carl Carmean.

Vickery and Miles, winners of last year's contest, did not compete.

Pacific Coast Borax Concentrator Destroyed by Fire

The concentrating plant of the Pacific Coast Borax Co. at Death Valley Junction, south of Goldfield, Nev., was destroyed by fire on June 30. Loss is given as $50,000, which was covered by insurance. Company officials say that the loss will not interfere with regular production.

Beer, Alcohol, and Mining in the Belgian Congo

A NEW ENTERPRISE has been established at Elisabethville, in the Belgian Congo, in the guise of an important brewery, as an adjunct to the Mining Union of the Upper Congo, the purpose of which is eventually to restrict the consumption of alcohol among the colonists in general and above all among native workers in the district and the native labor employed in the vast mining enterprises of the region. It is perhaps the first time in history that such an effort has been made by an industry on its own account, and though in no sense a philanthropic project, it is allied closely with the economic and efficient conduct of this important Belgian colony, and is a move not toward prohibition but toward a more sane consumption of liquid refreshment which shall stimulate the worker in a more logical manner than the absorption of rough alcohols which have been the curse of the development of most interior African projects of other nations. Belgian foresight and action have pointed the way to a closer alliance between industry and humane interests in general, and will be followed with the attention and interest of all the world.

Two Sulzer ammonia compressors installed at the brewery will permit the making of ice and are also expected to improve living conditions in this vast equatorial territory, which was brought under Belgian control by the astuteness of the late King Leopold.

Steam shovel loading copper ore at the Chino mine at Santa Rita, N. M.

Dome Mountain and Duthie Operations Abandoned by Federal M. & S.

Following an examination by the general manager, Mr. Burbidge, the Federal Mining & Smelting Co. has closed down operations at all the properties it had under development contiguous to the Grand Trunk Pacific Ry.; these consist of the Jefferson group of claims, at Dome Mountain; Duthie Mines, at Hudson Bay Mountain; a prospect at Ownes Lake, and two prospects near Usk. The first two were operated by subsidiary companies, the Dome Mountain Gold Mining Co., Ltd., and Duthie Mines, Ltd.

Henry Lee, superintendent of Dome Mountain, stated that the Federal company had given all the properties a fair test and that the orebodies had not held up in value or size under development. At Dome Mountain he had driven about one mile of tunneling on the four principal showings. Similar conditions were true of the other properties. The company has had the Dome Mountain property under development for fifteen months.

The closing of Duthie mines is the biggest surprise, as since J. F. Duthie started to develop the properties nearly 2,000 tons of high-grade ore has been shipped to the smelters. In July of last year the Federal company bought a 55 per cent interest in the properties, Mr. Duthie retaining the remainder. Recently Mr. Duthie and John R. Turner, assisting engineer, made an examination of the properties, and, it is stated, Mr. Turner was far from satisfied with the work that was being done. It is understood that Mr. Duthie purposes to continue the exploration. Between 25 and 30 carloads of ore are in transit to the Selby smelter.

This is the third serious setback that this district has had. In 1918 the Rocher de Boule mine was closed, after producing 5,750,000 lb. of copper, 63,000 oz. of silver, and 4,200 oz. of gold, and in 1921 the Silver Standard mine was closed, after producing 1,055,000 lb. of lead, 1,214,000 lb. of zinc, 55,500 oz. of silver, and 980 oz. of gold. A Vancouver syndicate has the reopening of the Silver Standard under consideration.

Metal Production in Mexico Rises

The mining section of the Mexican Department of Commerce and Industry has just rendered the following report of metal production in the republic for the first three months of 1924:

	Kilograms
Gold	6,554
Silver	689,490
Lead	36,236,385
Copper	11,048,612

For the same period last year the result was:

	Kilograms
Gold	585
Silver	45,914
Lead	2,036,089
Copper	821,000

The department believes that this will be a banner year for the production of metals and minerals in Mexico.

Joplin-Miami Curtailment in Name Only

Curtailment in the Joplin-Miami district, due to the Fourth of July holiday, was disappointing. It had been expected that production for the week ended July 5 would not be in excess of 5,000 tons, but it has been officially estimated at almost 10,000.

The comparatively large output is explained by the fact that numerous mines that had planned to be down for two weeks following the Fourth opened on the following Monday, and others that were to have been down for three days were down only for July 4.

The surplus of ore in bin in the district is climbing once more, and it is feared by producers that a lower selling price will result. Some of the largest companies are curtailing notably, but the smaller companies seem unable or unwilling to co-operate.

Keeley Mine to Develop Existing Levels

Hamilton B. Wills, president of the Keeley mine, in South Lorrain, Ontario, who has returned from a visit to the property, states that there are such great possibilities for ore near the surface still undeveloped that the management proposes to develop it rather than sink to lower levels at present. The 8th level was the best looking in the mine, as values were probably steadier there than on the 7th level. It was expected that production would hold in the neighborhood of 150,000 oz. per month.

Hematite Discovered Near Helen Mine, in Michipicoten District

An extensive deposit of hematite iron ore has been disclosed on the claims of Allen Gibson, about 5 miles east of the Helen iron mine, in the Michipicoten district of northern Ontario. About 2,000 ft. of trenching has been done, and a number of shallow pits have been sunk, proving the occurrence of a large orebody, assays of which show from 50 to 67 per cent iron content and low sulphur and phosphorus. The ore is similar in quality to that of the old Helen mine, and surface indications are that it is continuous throughout the claims and of a good width.

Mr. Gibson is pushing development on a large scale, and after further stripping and trenching will undertake diamond drilling to ascertain the depth of the deposit.

Michigan Copper Shipments Increased in June

Michigan copper shipments by boat in June were 8,172,000 lb., compared with 5,358,000 in May. There was shipped from the Calumet & Hec'a docks, 5,120,000 lb.; from the Michigan smelter, 1,774,000; and from the Quincy docks, 1,278,000. Several million pounds were shipped by rail, total deliveries by boat and rail about equaling production for the month, 10,580,000 lb.

Italian Government Auctions Elba's Iron Mines

A SIGNIFICANT recent development has been the calling for bids on the part of the Italian Government for the concession of working of the iron deposits of the Isle of Elba. Whatever may be said of the Mussolini government, it is avowedly for Italy and committed to a course that will assure that all resources within the country's borders shall be exploited in the interest of the government treasury.

At the adjudication which was held at Leghorn on June 18 there were several bidders, of which the Elba company, the actual concessionaire, the reorganized Ilva interests, and the Montecatini company were the chief. The rivalry was keen, and each in turn raised the bid until finally the concession was adjudged to one Commandatore Pietro Vigue on the base of 3.65 lire per ton of mineral extracted. The bid was made on behalf of a company still in process of organization, which, however, is believed to include the former "Elba" interests or a group sustained thereby.

Mussolini has never insisted that his nationalism should go so far as nationalizing monopolies — mines among others, as well as railways, telephones, and telegraphs. Indeed, he has many times announced that in case they did not bring in an adequate return he would put them in private hands for exploitation. This is perhaps the first step in the abolishing of government monopolies.

Cortez Silver Again a Producer

Repairs to the power plant of the Cortez Silver Mines Co., which was damaged by fire several months ago, have been completed, and mine and mill are again operating at capacity. The mill is treating 130 tons of ore per day. About 150 men are employed on this property.

Calumet & Hecla Railroad Contract Awarded to Chicago Firm

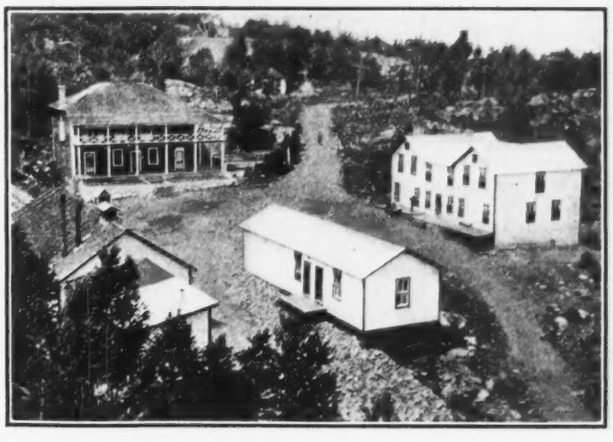
The contract for the construction of a nine-mile railroad between the Ahmeek mine and the Ahmeek stamp mill, in the Michigan copper district, has been awarded to the J. A. Roberts Bros., of Chicago, by the Calumet & Hecla Consolidated. No contract price has been announced, but the cost of the project is understood to be about one million dollars. The work of grading will be started at once and completion of the road is expected late in the summer of 1925. Several hundred men will be employed this summer.

The railroad will serve Ahmeek and other Kearsarge lode properties of Calumet & Hecla Consolidated. It will provide a shorter route to the stamp mill and an easy down grade for loaded cars, the grade averaging three-tenths of 1 per cent. Numerous ravines cross the right of way, and considerable cutting and filling will be necessary. Ahmeek rock now is handled by the Mineral Range railroad, which transports it up grade to Calumet and from there to Torch Lake.

Construction of the new railroad will ultimately result in a large saving for Calumet & Hecla Consolidated, for it will not be subject to government tariffs and regulations. Decision to proceed with the project is taken to reflect the faith of the company in the future of the Michigan district, which, to the district at least, is the most important feature of the construction.

Triplex Pumps for Tamarack No. 5 Shaft

Installation of electric pumps in No. 5 Tamarack shaft will simplify the pumping problem and reduce drainage expense in Calumet & Hecla Consolidated conglomerate shafts, in the Michigan copper district. Three vertical triplex pumps will do duty at the 87th level and three at a station 2,450 ft. from surface. The pumps will replace the bailers in No. 5 shaft and the pumps in use in Nos. 4 and 5 Calumet shafts.

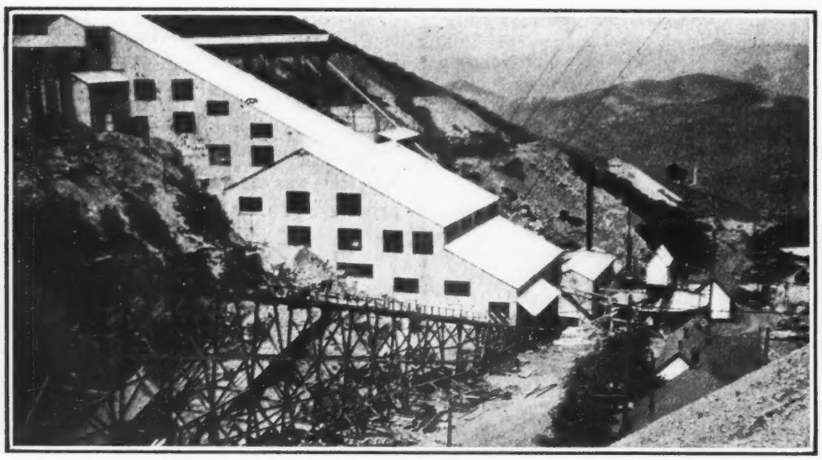


General office of Keeley mine, South Lorrain, on left. Bunk house on right

Utah Camps Maintaining Good Shipping Record

Tintic, Park City, Bingham, and Other Districts Showing Splendid Activity

THE Tintic district of Utah, with Eureka as its principal camp, during the first six months of 1924 produced 3,288 cars of ore, compared with 4,804 cars in the same period of 1923, when the Pittman Act was in full force. During the last half of 1923, 3,630 tons was shipped. During the first six months of 1924, three companies paid dividends: the Chief Consolidate, $178,422; the Iron Blossom, $25,000; and the Tintic Standard, $630,735. The latter company was the heaviest shipper, sending out 1,265 cars in the first quarter of 1924, compared with 1,079 cars for the last quarter of 1923. The high lead content of the Tintic Standard ores has been advantageous to the company at present metal prices. The mill is operating steadily, and much high-grade ore is being extracted.



Mill of the Silver King Coalition Mining Company, Park City, Utah

The Chief Consolidated was the second on the list, with 1,145 cars for the first six months of 1924. This company is rapidly completing its mill, and it expects to begin treating its low-grade ores in August. Comparing the output of the first six months of 1924 with that of the last six months of 1923, shippers were: American Star (first six months 1924), 3 cars, compared with 24 cars for the last six months of 1923; Bullion Beck, 20, compared with 14; Centennial-Eureka, 27, compared with 11; Chief Consolidated, 1,124, compared with 1,474; Colorado, 88, compared with 112; Dragon Consolidated, 184, compared with 284; Bingham Mines, 264, compared with 143; Iron Blossom, 158, compared with 134; Iron King, 12, compared with 61; Mammoth, 50, compared with 109; Plutus (a new shipper controlled by the Chief Consolidated), 51 cars, compared with 8; Tintic Drain Tunnel, 3, compared with 1; Tintic Milling, 15, compared with 3; Tintic Standard, 1,265, compared with 1,079; Yankee, 1, compared with 2; Godiva, 9; May Day, 1; Uncle Sam, 2.

Lower shipments from the camp as a whole for the first one-half of 1924 are due to the discontinuance of the shipment of dump ore, marketable under the Pittman Act, and lessened shipments of fluxing iron ores by the Dragon and Iron King, while iron ores were under lease to smelting companies. The Tintic district, therefore, while production was not up to that of the intense output under the Pittman Act, is holding up well, and the year is expected to be a good one. The operation of the Chief Consolidated mill is awaited with interest, also. Developments at this company's new shipper, the Plutus, have been favorable.

Park City, Utah, during the first half of 1924 shipped 102,900 tons of ore and concentrates, compared with 131,460 during the same period of 1923. Shipments, however, during the last half of 1923, amounting to 65,705 tons, were about 50 per cent lower than those for the first half of 1924. The present rate of production also is such that the total for the year promises to exceed the total for 1923, which (with 199,115 tons) was the most productive year in the history of the camp. This heavy production is due to the heavy lead content of the Park City ores and to the excellent physical condition of the mines. The Silver King Coalition, with 38,844 tons, was the heaviest shipper. This is compared with 27,135 tons in the last half of 1923. The Keystone shipped 10,203 tons, compared with 2,080 tons for the last half of 1923; the Park City Mining & Smelting, 28,579 tons, compared with 27,135 tons; the Park-Utah, 25,230 compared with 10,818 tons, and the New Quincy, 40 tons.

The purchase of the Silver King Consolidated by the Silver King Coalition, adding much promising new ground to this property, is an interesting event of the period. This property is able not only to pay $800,000 for the Consolidated, but continued dividend payments. The Keystone increased shipments from 2,080 tons in the last quarter of 1923 to 10,203 tons in the first quarter of 1924.

Dividends by Utah mines during the first six months of 1924 amounted to $5,010,768, compared with $4,983,992 in the first half of 1923. The Utah Copper, the largest single dividend payer, paid $3,248,980. The largest dividend payer among the silver mines of the state was the Tintic Standard, which paid $630,735. The Chief Consolidated, like the Tintic Standard, in the Tintic district, paid $178,442; and the Iron Blossom, also of the district, $25,000, making a total of $834,178 by the silver-lead mines of Tintic. The Silver King Coalition (not counting a dividend of $182,415 paid on July 2), with $364,830, was the largest dividend payer in the Park City district; the Park City Mining & Smelting paid $262,800 (paying also $151,400 on July 2, not counted in the first six months); and the Park-Utah paid $300,000. The total for the camp of Park City was $927,630.

Tonopah Output Normal

Tonopah June production was approximately 420,000 oz. of silver-gold bullion, valued at $360,000, which is normal for the district. Regular development was carried on in the different mines with satisfactory results. No new important discoveries were reported last month.

Important plans are being considered which may result in new and extensive development work being started in the Jim Butler, Montana Tonopah, Midway, and some of the western properties.

Tonopah Mining Options a Rouyn Property

The Tonopah Mining Co. is reported to have taken an option on the properties of the Arntfield Syndicate, in the Rouyn district, Quebec, which controls a large acreage on which very promising discoveries have been made. The price is about $1,250,000, but this no doubt will be strung out over a sufficiently long period to give the Tonopah company an opportunity thoroughly to prove the ground. The Coniagas has also taken an option on a considerable acreage in that section.

Alaska-Premier Mining Co. in Legal Difficulty

B. Guggenheim, of New York, has obtained a judgment against the Alaska-Premier Mining Co. for $20,000, money that he had advanced from time to time for the development of the Alaska-Premier mine, and unless payment is made before July 30 the property will be sold at a sheriff's sale to satisfy the judgment. The property is situated up the Salmon River, 10 miles from Hyder, and consists of twenty-six claims, all in Alaskan Territory. Some promising veins are said to have been opened on the property.

Acme Zinc & Lead Sinking New Shaft

The Acme Zinc & Lead Co. is putting down a new field shaft on the southeastern part of its lease at Picher, Okla., which will be connected with its present mine by drifts.

News from Washington

By PAUL WOOTON
Special Correspondent

Director Bain Finds Heavy Taxation Holding Back Mining

Co-operative Agreement Established With British Mine Officials

A CRYING NEED of the industry engaged in the mining of non-ferrous metals throughout the world is taxation reform. This is the testimony of mining men, from many countries, who assembled at London last month for the Empire Mining and Metallurgical Congress, according to H. Foster Bain, the director of the U. S. Bureau of Mines, who just has returned from the British Isles.

Under present-day conditions, most mining operations must be conducted on a large scale. Millions in capital and many years' time are required. In non-ferrous operations, particularly, large profits must be taken from the successful operations in order to offset failures. The system of taxation followed in most countries makes heavy levies on large profits and makes no provision for the recouping of losses which may have occurred in other operations. As a consequence, mining development is being discouraged throughout the world. The fact that the world has been on a low consuming basis, Mr. Bain points out, has made it possible for existing mines to meet the demand. Should there be any marked upturn in world prosperity, serious shortages of certain of the non-ferrous metals will result. Tax reform then is likely to be forthcoming at the demand of the consuming industries. Owing to the length of time necessary to get mining operations into quantity production, a considerable period must elapse during which the consumers will have to pay for the lack of foresight on the part of those responsible for taxation policies.

Reparations Admitted To Be the Stumbling Block

The return of world prosperity depends upon the solution of reparation difficulties. The consensus of opinion among mining men at the London congress seemed to be that the whole-hearted support of France for any effective reparations plan must await some guarantee for her future security. Until there is some international effort to that end, it is feared that the French will find ways of retarding Germany's economic rehabilitation. Mr. Bain, however, heard only favorable comment on the Dawes plan.

The Empire Mining and Metallurgical Congress, Mr. Bain declares, was an unqualified success. The papers presented were of unusual excellence and there was an unexpectedly large attendance of representative mining men from all parts of the world.

One of the facts established clearly at the congress was that the negotiations looking to the rehabilitation of the Russian mining industry had made absolutely no progress. Moreover, there is no promise of improvement.

The gathering of mining men in London revealed a growing appreciation of the importance of the Katanga copper and the part it will play inevitably in the general copper situation. There now seems to be no doubt that these deposits extend into northern Rhodesia, where large-scale operations are to be undertaken by a syndicate having the backing of Minerals Separation interests, A. Chester Beatty, W. G. Perkins, and P. K. Horner. Their plans include large-scale application of the Perkins process of using ammonia in the treatment of copper ores, and a 1,000-ton plant is under construction.

American Capital Interested in Diamond Mining

Significance was also attached in London to the growth of American holdings in the production end of the diamond industry. Until recently, the De Beers Consolidated and the Kimberley mines have dominated the situation. Development of diamond properties in the Congo, Angola, and old German Southwest Africa by American interests have been so extensive and so satisfactory that the new fields apparently are assuming a commanding position in the industry.

The principal purpose of Mr. Bain's trip was to arrange the actual program for co-operative work between the American and British governments on safety in mining. In addition to interchange of the results of previous research work, a technical representative of the British Government will be assigned to the Pittsburgh, Pa., station of the Bureau of Mines, and a member of the Bureau's technical staff will be accorded similar facilities to observe the progress of British work. The Bureau is to undertake tests of the British permitted explosives. They have had less success in the development of explosives especially designed for coal mine blasting than has been the case in this country.

A. C. Fieldner, the superintendent of the Pittsburgh experiment station, with a member of his technical staff, is now in England conferring with the Fuel Research Board of Great Britain in connection with the various problems relating to the processing and better use of coal. This is looking forward to the time when it will be necessary to supplement petroleum supplies with benzol and other oils derived from the by-products of the distillation of coal. Every effort will be made to avoid duplication of effort in research work.

Mr. Bain spent much time with Mines Minister Shinwell, and it is entirely probable that co-operation between the two governments in fact will be much broader than the actual agreement which is limited to matters pertaining to safety.

Silver Research Work Transferred

THAT portion of the research work on silver which was being conducted by E. I. Shaw, who recently resigned from his position with the U. S. Bureau of Mines, has been taken over by Dr. E. L. Mack. He will work as a Bureau of Mines employee at the Bureau of Standards in co-operation with Dr. H. W. Gillette. This in no way will interfere with that portion of the silver work being done at the Reno station of the Bureau.

Secretary Work Appoints N. W. Smith to Study Alaska Road

Hubert Work, Secretary of the Interior, has announced the appointment of Noel W. Smith, assistant to the General Manager of the Pennsylvania Railroad, as special assistant to the Secretary of the Interior to make a detailed study of the Alaska Railroad.

Mr. Smith, who was granted a leave of absence by the Pennsylvania Railroad, will proceed at once to Alaska. Under this title he will serve as a personal representative of the Secretary in the supervision of construction, operation and maintenance, finance, the personnel and other activities of the Alaska Railroad in the field.

Mr. Smith's appointment contemplates the making of a complete survey of the road and such reorganization as may be necessary for its betterment.

Secretary Work, in a statement just issued, said: "As a result of several months' search for an expert in railroad organization and management, who could be temporarily relieved from his duties, I have appointed Mr. Smith, of the Pennsylvania Railroad, to survey the physical condition and organization of the Alaska Railroad, its freight and passenger possibilities, and to make a comprehensive report with recommendations on its requirements, policy, and necessities. Since the completion of the Alaska Railroad no report has ever been made by an experienced railroad operator. To carry out this obvious necessity was the purpose of this appointment."

$25,000 More to War Minerals Producers

Awards of five war minerals claims were made at the U. S. Interior Department, on July 10, the total amount involved being $25,657. The claimants must accept the awards of the government before final payment is made. The claimants and the amounts awarded follow by states:

Arizona

Spurgeon, Lunsford & Lunsford, Bowie, $2,171.08.

California

The Sawyer Tanning Co., Napa, $1,411.62.

Virginia

A. S. Adams, Rocky Mount, $788.66.

West Virginia

Pocahontas Manganese Corporation, Bluefield, $16,159.31.

Wisconsin

J. J. O'Loughlin, Waukesha, $5,126.84.

A New Tool for the Prospector —the Zeppelin

THE suggestion was made to the World Power Conference, on July 9, by Dr. Taussig, of Austria, that the United States might usefully employ its new Zeppelin, the ZR-3, which is now being completed in Germany, in surveying the arid regions of the West for water-bearing soils and various ores.

Dr. Taussig explained that the airship could be used for this purpose by utilizing a new process now being perfected whereby short radio waves can be sent out continuously. If these waves are reflected from the ground under survey, he said, it will be an indication of the presence of waters and ores.

London Letter

By W. A. Doman

Special Correspondent

Tharsis Sulphur & Copper Co. Shuts Down—Kwahu Gold Area Revives

London, July, 1, 1924—As so much British capital is invested in tin mining properties, the price of the metal is a never-ending source of interest here. Few producing companies can afford to hold stocks, and not all enter into forward contracts. It is, therefore, mostly a matter of luck to make a favorable market deal. When the price was above £270 per ton, it acted as a fine stimulus to the industry, and there was naturally much disappointment when it fell to approximately £200 again. Mr. Ricard, of Ricard & Freiwald, clearly understands the position from A to Z. His view seems to be that at £300 or anything approaching it tin is too dear, while at £200 the reverse is the case. Apparently he regards a level of £225 or £230 as a good working figure. Producers, viewing the position from a different angle, are naturally not wholeheartedly in agreement, as their side of the question is largely determined by working costs, taxation, freight, and other factors.

The Tharsis Sulphur & Copper Co. is shutting down its works at Cardiff. The report is that pure sulphur is brought into the country so cheaply that the treatment of pyrites becomes unprofitable. At the meeting of the company held on April 16 last, it was not stated that the works were to be closed down, but that last year they were not fully employed, owing to an insufficient supply of pyrites cinders. The heavy chemical and fertilizer trades in this country have been and continue, it is said, in a depressed state, and in consequence the shipments of pyrites to this country were much below the normal, and this curtailed the supply of material for the works. Possibly the decision to close down is the result of a continuation of these conditions as well as the cheaper supply of sulphur.

A revival is taking place of alluvial gold mining on the West Coast of Africa, and the railway from Accra to Coomassie, which was completed and opened to traffic last year, passes through what is described as the highly mineralized Kwahu district. Little has been done here for many years, but as far back as 1899 a mining expedition examined the district, and in a concession covering an area of 5 square miles discovered what was reputed to be the richest deposit in Kwahu. At that time difficulties of transport prevented the development of these alluvial gold areas. Activity is now general in the district, and all the properties adjoining the 5 square miles have been taken up by various mining companies. The Kwahu Mining Co., which has acquired an area adjoining the southern boundary of that belonging to the Tarquah Banket West, plans to erect a hydraulic sluicing plant to treat the auriferous gravels. It is claimed that by this method the gold can be won at low cost.

The rise in the price of arsenic and the demand for the mineral have resulted in the formation of a company to acquire a mine in Devonshire which is rich in this product. The company is the Goldfields of Mysore, which is more or less of a finance undertaking, and it is believed that the arsenical ore can be economically treated. While on the subject of arsenic, it may be mentioned—and I have referred to the company on previous occasions—that the South American Gold Areas, operating in Brazil, has opened up ore that is high in arsenic and that is said to find a ready sale locally. Many years ago the property was abandoned, owing largely to lack of facilities for economic working and the change of the ores from oxides to sulphides. It is now under the technical management of Bainbridge, Seymour & Co. and according to latest advices is expected to develop into a much larger proposition than originally expected.

Johannesburg Letter

By John Watson

Special Correspondent

Rhodesian Mineral Production Increasing—Prospecting for Platinum Active

Johannesburg, June 9, 1924—The following results for the month of May, from the leading profit-earning gold mines of the Rand, have just been published.

The mineral production of Rhodesia for last April shows an increase of £30,462 in value over that of March. Of this increase, £16,000 was attributable to the higher premium on gold. The details are as follows:

	April	March
Gold	£256,352	£236,166
Silver	1,522	1,461
Coal	20,798	20,156
Copper (blister)	14,846	15,058
Chrome ore	38,243	33,892
Asbestos	43,395	37,491
Arsenic	337	1,202
Scheelite	500	.....
Mica	1,590	1,505

A diamond weighing 42½ carats, of very beautiful quality, was found on June 5 on Barkly Commonage, where a "rush" of diggers has taken place during the last few weeks.

The eighteenth annual statement of the Trade and Shipping of the Union has recently been published. Mining machinery to the total value of £734,441 was last year brought into the Union. The value of that imported from the United Kingdom was £407,148. That from the United States, valued at £270,129, came second, and from Germany the value was £30,923. The United Kingdom had increased its share by £56,000, compared with 1922. The imports of American machinery in 1922 were valued at £154,119 and in 1920 at £347,000.

At the annual meeting of the Transvaal Consolidated Land & Exploration Co., (known locally as the T. C. L.), the chairman (Max Honnet) referred to the discovery of platinum in the Waterbury district and the formation of the syndicate known as Transvaal Platinum, Ltd., in which the T. C. L. held 16,000 out of a total issue of 60,770 shares. A great deal of prospecting and development work had been done, and, in certain sections of the formation, highly encouraging values have been exposed. The occurrences are, however, erratic, and it is as yet too early to express a definite opinion as to the outcome of this venture. It can, however, be said that results to date afford every encouragement for the continuation of exploratory work and considerable hope of success.

Rand Gold Production for May, 1924

	Tons Crushed	Value or Revenue	Costs per Ton Milled s.	d.	Estimated Profit
Government Areas	159,500	£335,378	17	3.9	£200,287
New Modder	122,000	267,010	17	2.7	161,931
Crown Mines	222,000	308,977	19	3.4	94,903
Van Ryn Deep	67,900	144,189	19	1.6	80,133
Modder Deep	45,500	112,374	16	2.0	75,620
City Deep	100,000	187,736	22	11.8	72,818
Randfontein Central	209,000	263,537	18	7.5	70,171
Modder B	68,000	132,793	19	3.0	67,336
Springs	64,800	123,440	22	4.7	62,435
Brakpan	76,100	127,314	20	8.1	60,195
Geduld	71,000	116,545	18	9.0	49,871
Robinson Deep	75,500	.....	17	11.6	43,930
New State Areas	70,000	117,883	21	3.7	43,622

New Daily Airplane Service to Rouyn District

COL. J. SCOTT WILLIAMS, of the Laurentide Air Service, announces the establishment of a new daily airplane service from Haileybury, Ont., to the Rouyn gold fields, going into operation on July 15. It will make direct connection with the Continental Limited of the Canadian National Rys., reducing by twenty hours the time taken in making a journey to Rouyn by the present route.

Teck-Hughes Has Deepest Shaft in Kirkland Lake District

Encouraging developments continue throughout the Kirkland Lake district, in Ontario, and there are now six shafts down to a depth of below 1,000 ft., with others being sunk. The deepest workings in the camp are at 1,600 ft., which is on the Teck-Hughes property. Conditions at this property are satisfactory, and the company has a surplus of approximately half a million dollars and is producing at the rate of about $90,000 a month.

Sinking of the new main shaft has been started and will be carried on continuously. So far, no effort has yet been made to sell the treasury shares to pay for the new shaft and to provide increased milling facilities. The general mining market is not very good, and it is felt that the present is not an opportune time to make a distribution.

New Mill Contemplated for Yerbabuena District

Preparations are being made to install a mill for extracting and treating the ores from the noted Mina Grande, situated in the Yerbabuena camp of the Rodeo district, State of Durango, Mexico. This property, together with the Poder de Dios and La Esperanza, is owned by D. F. Anderson and associates, of Kingsville, Tex., who acquired them a number of years ago.

The full name of the principal group of claims is Mina Grande de la Paz, which was worked by the Spaniards in times so remote that no one in the vicinity has any idea when it was first discovered. However, there are records in the City of Durango showing an ancient production of $14,000,000. The greatest depth reached by shafts at this time is now scarcely 200 ft., yet from the three distinct veins which traverse the property this immense sum was taken above this level. A sight of the vast dumps along these veins proves that extraction has been enormous.

New Brunswick Experiment Station Investigating Anhydrite

Laboratory work on the utilization of anhydrite is now under full headway at the New Brunswick, N. J., station of the U. S. Bureau of Mines. One of the problems on which work is being done is the determination of the value of anhydrite as a cement retarder. The almost invariable tendency in American gypsum mines to encounter larger and larger proportions of anhydrite as depth is attained has greatly increased the need for finding a use for the anhydrite, which is now not utilized.

Flowery Mines Mill in Operation

Alex Wise and R. A. Hardy, of the Flowery Mines Co., in the old Flowery district near Virginia City, Nev., and on the Comstock Lode, have erected an all-sliming cyanide plant to treat ore from the Flowery mine. The mill will handle from 150 to 200 tons per twenty-four hours. It is now in operation. Gold and silver ore is being treated. Filtration in series and precipitation with zinc dust and the Merrill-Crowe vacuum process is used.

Jimulco to Resume

The Jimulco mines, of the Jimulco Mining Co., composed of San Antonio capital, will soon resume operations after being idle for several months. The boilers, engines, and other machinery are being overhauled. The properties are located in the Jimulco Mountains about 50 miles south of Torreon, Coah., and connected with the main line of the National Railways at Otto station by a narrow-gage railroad owned and operated by the Jimulco mining company.

Capital Prize Driving Tunnel

The Capital Prize Mining Corporation, of Tuscarora, Nev., is actively pushing its operations in the Centennial mining district, 35 miles north of Tuscarora. A tunnel is being driven on the old Pioneer claim to strike the recently opened vein, which assayed 1,000 oz. of silver and 2.40 oz. gold. The company owns, in addition to the Pioneer, eleven promising patented lode claims in northeastern Nevada. J. F. Parsons, of Elko, Nev., is president and general manager and in direct charge of the work.

Labor More Plentiful in Northern Michigan

Experienced miners have been more plentiful of late in the Michigan copper district, and as a result Copper Range Consolidated has been able to enlarge underground forces. A small increase in production will be possible in July.

A number of men have come from the iron districts, where operations have been curtailed, and others from industrial centers due to the lull in the automobile plants. Opening work continues with satisfactory results as to copper content in Champion, Baltic, and Trimountain.

Assay Plant for Rufus Claims at Stewart

An assay plant and other equipment is being transported from Stewart to the Rufus group of mineral claims, situated in the upper Bear River section, Portland Canal, British Columbia. Camp accommodation is being constructed and a program of development that will extend over a considerable period has been planned.

New chemistry building of the Montana State School of Mines at Butte

U. S. Bureau of Mines to Stage Mock Disaster at Congress Convention

Elaborate preparations are under way for the staging of a mock mine disaster at the twenty-seventh annual convention of the American Mining Congress to be held at Sacramento in September next, to demonstrate the risks inherent to underground work and the measures available to effect rescue. The U. S. Bureau of Mines life-saving exhibit will include a section of a stope, with miners at work. Probably twice daily during the convention a mock disaster will be portrayed, showing the effect of premature explosion in the form of concussion and fumes, the actors in realistic manner being apparently stunned by the shock and overcome by the poisonous gases.

The Bureau rescue team, equipped with masks, will then fight its way to the "stope" and rescue the men. The first-aid car will be available at a nearby railroad siding, and the special safety automoblie, used at the Argonaut disaster of Aug. 22, 1922, will also be a feature of the "show." Underground workers from the mines of Grass Valley and Jackson will take part.

Trail Smelter Receipts

Following is a statement of ore received at the Trail smelter for the periods noted:

June 22 to 30, Inclusive

Name of Mine	Locality	Tons
Esperanza	Alice Arm, B. C.	6
Knobhill	Republic, Wash.	110
Lord Roberts	Rossland, B. C.	7
Monitor	Three Forks, B. C.	1
Motherlode	Poplar Creek, B.C.	2
Quilp	Republic, Wash.	216
Ruth	Sandon, B. C.	39
Standard Frn	Beaverdell, B. C.	7
Silversmith, lead	Sandon, B. C.	129
Silversmith, zinc	Sandon, B. C.	101
Sally	Beaverdell, B. C.	44
Van Roi	Silverton, B. C.	41
Company mines		12,425
Total		13,128

July 1 to 7, Inclusive

Name of Mine	Locality	Tons
Cork Province	Zwicky, B. C.	37
Eholt	Greenwood, B. C.	5
Hewitt	Silverton, B. C.	29
Knobh ll	Republic, Wash.	166
Lucky Thought	Silverton, B. C.	51
Molly Hughes	New Denver, B. C.	6
Monarch	Field, B. C.	42
Providence	Greenwood, B. C.	23
Quilp	Republic, Wash.	55
Roseberry Surprise	New Denver, B. C.	36
Silversmith, lead	Sandon, B. C.	129
Silversm th, zinc	Sandon, B. C.	50
Standard	Silverton, B. C.	164
Company mines	Silverton, B. C.	4,530
Total		5,323

Men You Should Know About

J. Dunlop, of Haileybury, Ont., has resigned his position as manager of the Hattie gold mine.

O. J. Egleston, of Kennett, Calif., in charge of the Mammoth smelter, was recently in San Francisco.

Robert Gamble has resigned the management of the Silver Bullion mine of Elk Lake, northern Ontario.

Clyde A. Heller, president of the Tonopah Belmont Development Co., recently visited Tonopah and Hamilton.

Emmet D. Boyle, manager of the Mason Valley Mines Co., at Yerington, Nev., is in San Francisco on business.

C. J. Kinnear, smelter superintendent of the Nevada Consolidated, McGill, Nev., recently made a trip to San Francisco.

Eugene Dawson is examining mining properties in British Columbia. He will return to New York in three or four weeks.

James Denny, formerly with the Nipissing, of Cobalt, has been appointed mill superintendent of the McIntyre-Porcupine.

Charles R. Miller, president of the Tonopah Mining Co. of Nevada, has been in Tonopah and Hamilton from Wilmington, Del.

B. Guggenheim, of New York, was at Stewart, B C., recently, in connection with the foreclosure of his mortgage on the Alaska-Premier mine.

George R. Jackson, superintendent of mines for the Cleveland-Cliffs Iron Co., has returned from a visit to gold mines on the Comstock, in Nevada.

Dr. S. C. Lind, chief chemist of the U. S. Bureau of Mines, is paying inspection visits to the Bureau's stations at Pittsburgh and Columbus, Ohio.

W. B. Robinson has been made superintendent of the Blue Ledge mine, at Medford, Ore. The mine is operated by the Cia. Metalurgica Mexicana.

Louis Ware, formerly chief engineer for Iron Cap Copper Co., has been appointed assistant mine superintendent of the Miami Copper Co., Miami, Ariz.

Thomas W. Gibson, Deputy Minister of Mines for Ontario, has sailed for England to represent the Mines Department at the British Empire Exposition.

D. M. Beck will have charge of the flotation plant at the San Jose mines near Nacozari, Mexico, which will resume operation soon, after a shutdown of two years.

Alex K. McDaniel has been examining mining properties in New Mexico and Sonora recently, and will be in New York on professional business for the next few weeks.

Prof. W. L. De Baufre, of the University of Nebraska, is in Washington to acquaint the Board of Helium Engineers, of which he is a member, with the results of some of his recent studies.

Prince Gelasio Caetani, Italian Ambassador to the United States, who sailed from New York last week to spend a summer vacation in Italy, will return to his post at Washington in October.

Roy Reeder, superintendent of the North Texas district for the Gulf Production Co., has resigned. Mr. Reeder will enter the contract drilling business, at Wichita Falls, Tex.

Clarence G. Dresser has been appointed mill superintendent of the St. Louis Smelting & Refining Works of the National Lead Co., at St. Francois, Mo. He will continue, also, his former duties as metallurgist.

Colonel John C. Greenway

Colonel John C. Greenway, distinguished mining engineer, and general manager of the Calumet & Arizona Mining Co., was the first man placed in nomination for the office of Vice-President of the United States at the Democratic National Convention which closed in New York on July 10, Arizona presenting his name on the first ballot for Vice-President. The news story appears on page 105.

Robert J. Anderson has resigned as metallurgical engineer of the U. S. Bureau of Mines, and is now engaged in Boston in general consulting engineering practice, specializing in the metallurgy of aluminum.

W. M. Weigel, a chemist on the staff of the U. S. Bureau of Mines, is studying certain phases of the non-metallic and ceramic industries in Pennsylvania and Ohio. He is giving particular attention to the silica industry.

G. W. Laurie has resigned his position with the Nevada Consolidated Copper Co. and entered business in St. Louis in the manufacture of chilled-steel grinding balls and ball-mill liners, under the name of Industrial Products Corporation.

C. A. Banks, consulting engineer for the Kafue Copper Development Co., of London and Rhodesia, is at Barkerville, B. C., to inspect and direct the construction of the dredge that the company is building on Antler Creek, in the Cariboo district.

H. G. Ferguson is engaged in field work in the Hawthorne quadrangle, Nevada, for the U. S. Geological Survey. His headquarters are at Mina. He is assisted in the geologic mapping of this quadrangle by **W. F. Foshag,** of the U. S. National Museum.

David Cole, consulting engineer of El Paso, Tex., who, as reported in the June 28 issue of *Mining Journal-Press,* was seriously injured recently in an automobile accident near Apache, Ariz., is still confined to his bed with a dislocated hip, but is reported to be making a satisfactory recovery.

D. J. Parker, safety engineer of the Bureau of Mines, with headquarters at Pittsburgh, is on an inspection trip through Alaska. The principal object of Mr. Parker's visit will be to work out plans for supplying and equipping a mine service car for use in Alaska. The car will be equipped with the very latest safety devices and will be used for instruction purposes and also for emergency work in case of mine disasters. He is accompanied by **B. D. Stewart.**

F. A. Starkey, Commissioner of the Associated Boards of Trade of Eastern British Columbia, a resident of Nelson, has been appointed to represent the Provincial Department of Mines at the Empire Exposition, Wembley, England. There is a first-class exhibit of provincial minerals at Wembley, and Mr. Starkey, who is well acquainted with mining conditions in the West, will be in a position to give first-hand information to any who may be interested in British Columbia's mineral products.

E. M. di Villa, oil geologist, is on a prolonged visit to Australia. He arrived in Melbourne, Victoria, at the end of May, after having spent four months in Western Australia and a month in South Australia. Mr. di Villa was graduated from King's College, London, and later studied at the Paris University. He has specialized in oil geology, and, having been granted twelve months' leave from the corporation by which he is employed, he has visited many of the oil fields of the world. He went to Western Australia from Borneo. Mr. di Villa is in Australia to collect first-hand data for a book he intends to write on the oil possibilities of that country. He is now visiting a number of areas in Victoria where oil indications have been reported. Mr. di Villa considers the possibilities of obtaining oil in commercially payable quantities in the western part of the Kimberleys, Western Australia, favorable, but does not think much of the prospects of either the southwestern part of that state or of Coorong, in South Australia, at which latter place a Victorian company holds oil concessions.

Obituary

Gilmour Ewing Brown, mining engineer, died on July 5, 1924, at Sierra Madre, Calif.

Hugh Hill, of Edward Hill's Son & Co., which marketed all arsenic produced by the American Smelting & Refining Co., died recently. His death has caused the dissolution of Edward Hill's Son & Co.

Societies, Addresses, and Reports

Joralemon Reviews Copper Situation

Says That Supply of Metal Will Hardly Last Score of Years at Intense Rate of Production That Must Come—Disagreement Voiced From Butte

COPPER MINES are working at 90 per cent of the output reached during the urgent demand of the war, and still the reserve supply of refined copper is shrinking, said Ira B. Joralemon, geologist and consulting engineer, in a recent address on the copper situation delivered before the Commonwealth Club of California. "Only one month stands between us and a copper shortage," he continued. "The mines which produce at least a quarter of the total supply have reached the last stage in which great depth, decreasing grade, and lower production have made it impossible to make a profit except at an unusually high metal price. And the total amount of copper which may reasonably be expected from known districts does not exceed forty years' consumption, at the present rate. In spite of this very favorable position, the metal is selling at far below the pre-war average price, and less than half the producers are making any reasonable return on their investment. Something surely is wrong with the copper business."

Summing up the situation, Mr. Joralemon said:

"Since the war the problem of the copper industry has changed from production to marketing. There will probably be an excess of productive capacity for several years. Other industries, by adjusting production to consumption, have prospered under similar conditions; but the copper producers were so poorly prepared for the new state of affairs that now only 20 per cent of them are making a fair profit.

"There is now no agreement among the producers as to the way out. Some advocate ruthless competition and the elimination of the unfit. This will mean years of low profits for the strongest, and ruin for many. A few argue that a high tariff will automatically bring high prices. In spite of the fact that domestic consumption has about caught up with production, most of the producers look coldly on this solution.

"The third solution is a slight voluntary curtailment by all producers and the adjustment of production to consumption. A 5 per cent cut in production would soon wipe out the small surplus of refined copper, and would surely bring a fair price. Then the poor could live and the rich could get richer. Other industries have come to this solution of the problem of excess productive capacity.

"Copper should be selling at 16c. a pound to yield a fair profit on a metal which industry requires. A 5 per cent curtailment seems a small price to pay for this return, and for prosperity."

In forecasting the future, Mr. Joralemon says:

"The present looks dark for the copper industry, even if the remedy seems so simple. But sometime, maybe one year, maybe ten years, from now, the day of the king of metals will come again. Super-power plants will demand every pound of copper that can be mined. We are just entering the era of electricity, and electricity cannot live without copper.

"The age of electricity and of copper will be short. At the intense rate of production that must come, the copper supply of the world will last hardly a score of years. Some day a mechanical civilization will find that the basis of its growth is gone. A rapidly shrinking production of copper will barely care for repairs of existing power plants. A frantic search for substitutes will prove unavailing. Our civilization based on electric power will dwindle and die.

"Then will come either a new civilization, simpler than ours and less material, or some new form of power, far more intense even than electricity. Will it be the release of the energy within the atom? This is the fascinating problem of the future—a race between science and the exhaustion of the copper mines.

"Copper is now despised and neglected, but we shall see it play the leading rôle in the drama of the future."

On the Other Hand

Every one does not agree with Mr. Joralemon, as might be expected. For one, the Butte correspondent of the *American Metal Market* does not. In a dispatch to that publication, he says:

"While Mr. Joralemon is a well-informed man, men of vast mining experience and men in this district who know every inch of Anaconda hill, generally known as the richest copper ground in the world, are not disposed to take seriously the statement that the copper supply of the world will be exhaused in the next twenty years. It is generally acknowledged that the domestic demand for copper today is the greatest in the history of the country, and still there is under a considerably curtailed production a large surplus. The Anaconda company, for instance, is today producing around 15,000,000 lb. of the red metal a month in this district and it could easily increase this amount to around three times that amount if the occasion required. With the 15,000,000 lb. a month being produced at present it should be remembered that all the big producing mines are idle. Six of the big producing mines are now shaft-sinking 600 feet deeper, and the fact has been clearly demonstrated time and again that the deeper the Butte copper mines go the richer and greater are the copper bodies. But Butte is only one copper district, although it can be justly said, an important one. Then there is Michigan, with its immense copper resources; Arizona, Utah, and South America, with its millions and millions of pounds of copper.

"Mr. Joralemon is much mistaken in his calculations as to the copper resources of the country, according to men who have made the red metal resources of the country a study for many years. Long after the twenty-year period stipulated by Mr. Joralemon, the Butte district alone will be producing copper at a rate of three hundred million pounds a month, or more if the occasion requires it."

Wood-preservation Research by Mellon Institute

Director E. R. Weidlein, of the Mellon Institute of Industrial Research of the University of Pittsburgh, has announced the founding of an industrial fellowship on the treatment of timber. This research, which is being sustained by the Grasselli Chemical Co., of Cleveland, Ohio, and conducted by Dr. A. M. Howald, has for its purpose a study of means for improvement of the methods of applying zinc chloride in the wood-preservation industry.

Investigational work which was begun during 1923 will be continued throughout the present year. An experimental wood-impregnating plant is maintained for practical tests of processes. Research is at present being done under the supervision of Dr. Howald on the development of a method of increasing the permanence of zinc-chloride treatments of timber by the addition of petroleum oils.

M.I.T. Summer Mining Camp Begins Work July 28

Classes in surveying at the summer mining camp of the Massachusetts Institute of Technology, near Dover, N. J., will begin July 28 and continue for eight weeks. Classes in mining practice and field geology extending over two weeks follow the instruction in surveying.

Last year, 1923, was the first in which instruction in these subjects was given at the new camp, which is admirably situated near the Replogle iron mine of the Replogle Steel Co.

Calaveras County Mining Men Organize

The mining interests of Calaveras County, Calif., recently organized under the title of the Calaveras County Mining Association. F. J. Estep, of Jenny Lind, Calif.. was elected president; S. M. Levy, first vice-president; R. C. Eisenhauser, second vice-president, John Scip, secretary, and D. A. Cavagnaro, treasurer.

Issues Report on Search for Cheaper Fuel

Commerce and defense have forced a worldwide quest for cheaper and more abundant fuel, according to the American Chemical Society, which has made public a report on international progress in this field by Dr. R. T. Haslam and Dr. E. W. Thiele, of the Massachusetts Institute of Technology. In it conditions in the leading nations are summarized.

Recent Technical Publications

Reviews, Abstracts, and References

Ventilating the Mine

Mine Ventilation and Ventilators. By M. H. Haddock. Charles Griffin & Co., London; J. B. Lippincott Co., Philadelphia.

The importance of coal-mine ventilation has been fully appreciated for a number of years, on account of the disastrous results of coal dust and gas explosions. The regularities of the methods of mining coal readily lend themselves to the introduction of a simplified system of ventilation, and consequently, mechanical ventilation of coal mines soon found universal adoption. The complicated workings in metal mines, however, made the introduction of ventilation more difficult, and it is only in recent years, since workings have become deeper and hotter, that the necessity for more healthful working conditions and greater efficiency has caused mechanical ventilation to be as important as it is in coal mining.

A very interesting publication which deals with the entire subject of ventilation for both coal and metal mines has been prepared by M. H. Haddock, who is principal of the Coalville and District Technical School, Leicester, England. The first three chapters are devoted to definitions of various terms used in the physics and chemistry of mine ventilation. Fundamental laws of gases are quoted and fully illustrated, and the subject of atmosphere and mine gases is taken up in considerable detail, stating methods of detection, testing and other factors. Chapter 4 discusses mine temperatures, humidity, and geothermic gradients; also methods of determination, including Dr. Leonard Hill's katathermometer. Mine pressures and resistances, the production of ventilation in mining, laws of mine ventilation, and the practice of mine ventilation occupy chapters 5, 6, 7, and 8. The theory of mine pressures and resistances has been carefully worked out and presented in a manner which can be clearly understood. The chapter on the production of ventilation traces the development from natural air currents, through the use of various mechanical devices, to the present well-developed mine fans. The last chapters contain extensive illustrations of the application of mechanical ventilation to coal mining, and Chapter 10 deals with a technical discussion of the principles of the design of mine fans.

The book is recommended to students of mine ventilation, who will find it an excellent text. It should also be useful to the practical operator, who may not be as much interested in the chapters upon the theory of ventilation as in those dealing with the practical application of mechanical ventilation to mining. CHAS. A. MITKE.

Compensation Insurance—The U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,607, is by Byron O. Pickard and is entitled "Premium Rates for Compensation Insurance for Underground Metal-mine Workers." It may be obtained for the asking.

Idaho Geology—The Idaho Bureau of Mines and Geology, Moscow, Idaho, has recently published Pamphlet No. 7, "Notes on the Geology of Eastern Bear Lake County, Idaho, With Reference to Oil Possibilities," by Virgil R. D. Kirkham, 6 pages; and Pamphlet No. 8, "Ground-water Supply at Moscow, Idaho," by F. B. Laney, V. R. D. Kirkham, and A. M. Piper, 13 pages. Either may be obtained on request. As to the oil possibilities in the region mentioned in Pamphlet No. 7, they are merely possibilities, not enough work having been done either to prove or disprove the district.

Refractories — *Chemical and Metallurgical Engineering* for May 12 (McGraw-Hill Co., New York; price 25c.) contains a 5-page article by O. A. Hougen on "Selection Factors in Choosing Refractories for Industrial Plant Use." The article is largely a tabular presentation of the physical and chemical properties of forty refractory materials and will be found valuable for reference purposes to all users of these materials.

Mining Tungsten in China — *Iron Trade* for April 24 (Cleveland, Ohio, price 25c.) contains a 3-page illustrated article by G. F. Creveling on "Mining Tungsten Ore at Outposts of Steel," showing the crude methods of mining, concentrating, and transporting used in China. Ordinarily, the ore is transported by women carrying baskets with shoulder poles and slings, although a "rapid" method has also come into favor, using wheelbarrows. This use of machinery is interesting. The economics of the industry are also briefly discussed.

Tennessee Marble—Bulletin No. 28 of the Tennessee Division of Geology, Nashville, Tenn., 264 pages, obtainable on request, is entitled "Marble Deposits of East Tennessee." Part I, "Occurrence and Distribution," is by C. H. Gordon; Part II, "The Constitution and Adaptations of the Holston Marbles," by T. Nelson Dale; and Part III, "Technology of Marble Quarrying," by Oliver Bowles. Quarrying marble is an important industry along the outcrop northeast and southwest of Knoxville, approximately 12 to 16 miles wide and 125 miles long. The third part of the book particularly, of 100 pages, will be found of interest to those in the marble industry throughout the world, as it is an excellent résumé of the technical phases of the industry. The book is a most creditable production.

Inventory—The Department of Manufacture of the Chamber of Commerce of the United States, Washington, D. C., has issued a revised edition of the bulletin "Perpetual Inventory and Stores Control," pp. 26, obtainable on request. This describes the methods used by large manufacturers in controlling their investments in raw materials and contains much of interest to mining companies having problems in this field.

Heat Losses—No. 254 of the Technologic Papers of the U. S. Bureau of Standards, Washington, D. C., 16 pages (price 5c. from the Superintendent of Documents, Washington, D. C.), is entitled "Emissive Tests of Paints for Decreasing or Increasing Heat Radiation from Surfaces." Data are given on the emissivity of sheet iron, cotton duck, roofing material, and artificial leather, covered with white paint, vitreous enamel, aluminum paint, and other coatings. Where heat transference is not desired, as in a kiln for drying or roasting, large savings can be made in the fuel required by painting the exterior with aluminum or bronze paint. An aluminum paint for automobile tops and ice wagons is suggested. On the other hand, a house radiator kept at a given temperature will give off 10 to 15 per cent more heat if it is painted with a non-metallic paint instead of the aluminum or bronze coatings commonly used.

Engineering Standards — The 1924 Year Book of the American Engineering Standards Committee, 29 West 39th St., New York City, has been issued, pp. 64, and will be sent on request. In the field of non-ferrous metallurgy, standards for electrolytic and Lake copper wire bars, cakes, slabs, billets, ingots, and ingot bars have been published. It has also been decided to undertake the standardization of zinc and zinc ores: this will include the definition of grades of slab zinc; gages, and tolerances for sheet zinc; physical tests for sheet zinc; methods of chemical analysis of zinc and zinc ores; and methods of sampling and weighing. In the mining field, the screening of ores is to be studied.

Alaska—Bulletin 755-C of the U. S. Geological Survey, Washington, D. C., pp. 80, obtainable on request, describes the geology and mineral resources of the region traversed by the Alaska Railroad. It is by Stephen R. Capps.

Canadian Mining — An article on "Canadian Mining Development" appears in the June 14 and 21 issues of *The Statist* (51 Cannon Street, London, E. C. 4; price 7d. each in the United Kingdom). Vigorous objection is made to the method of financing Canadian mining properties, the Standard Stock and Mining Exchange in Toronto being referred to as a hive of wasps.

Mining Industry of the British Empire — *The Mining Journal* (London, price 8d.) has issued a special edition in connection with the Empire Exhibition at Wembley, which reviews the mineral resources and activities carried on all over the world under the British flag. Much descriptive matter relating to processes used and technical results obtained is presented.

Carbon-monoxide Rescuers — "The Carbon Monoxide Self-rescuer," by A. C. Fieldner, S. H. Katz, and D. A. Reynolds, has been issued by the U. S. Bureau of Mines, Washington, D. C., as *Reports of Investigations* Serial No. 2,591, pp. 10, free on request. The paper describes the construction and details of the M. S. A. self-rescuer and discusses its performance under test conditions. This is a pocket-size gas respirator to protect the wearer from poisonous carbon-monoxide gas.

New Machinery and Inventions

Burning Heavy Fuel Oil in Diesel Engines

Tests Made During Past Winter Requiring Specially Designed Heating Equipment

By Reinhard Hildebrand
Chief Engineer, Diesel Division, Fulton Iron Iron Works Co.

IN CERTAIN sections of the United States, particularly in the South, and also in Cuba and other Latin-American countries, it is important that Diesel engines should burn heavy fuel oil of a grade similar to that of Mexican and bunker oils, because in these localities lighter fuel oils are often difficult to obtain and cost several times as much as the heavy oils above mentioned.

Heavy fuel oils, such as Mexican and bunker, containing a high percentage of carbon and a low percentage of hydrogen, have a high specific gravity corresponding to a low degree Baumé, a high viscosity and a high sulphur content, and their flash point is low, requiring a higher temperature for ignition and burning than lighter oils. It is obvious, therefore, that larger engines running at relatively low rotary speed are better adapted to burn the heavier oils than smaller engines having a high rotary speed, because in the larger engines the temperature in the combustion chamber is higher and the time available to convey the fuel oil into the combustion chamber and to burn the fuel is longer than in smaller engines. For these reasons the manufacturers of Diesel engines generally will not find it difficult to run their larger, slow-speed engines on heavy fuel oils, while in most cases they experience considerable trouble with their smaller high-speed engines when burning heavy oils.

It is a fact that some Fulton-Diesels have been operated for several years on Mexican oils, although they were not built to burn heavy oils. These Diesels are now designed to burn heavy fuel oil, and the Fulton Iron Works Co. has recently made exhaustive shop tests, lasting many weeks, with a small three-cylinder, single-acting four-stroke, vertical Diesel, having 13½x19½-in. cylinders, developing 200 b.hp. at 257 r.p.m. The results obtained with this engine while running on Mexican and bunker "C" oil have been most gratifying. There was no trouble in obtaining absolutely clear exhaust from no load up to 20 per cent overload, the engine taking the heavy fuel oil just as readily as lighter oils. The consumption of the heavy fuel oil compared with the light was in proportion to their heat values.

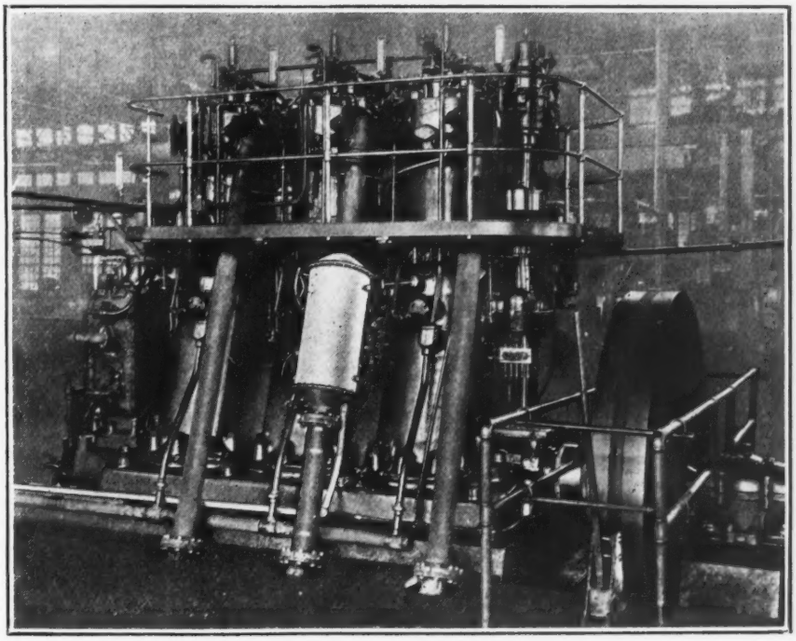
The tests were made during the cold weather which prevailed during January and February, 1924. Of course, the heavy fuel oils had to be heated before they could be handled, and it was necessary to equip the engine with specially designed heating apparatus. The aim of the fuel-heating system was to heat the heavy fuel oil to the point where it could be handled by the circulating pump and would flow by gravity from an overhead tank through the filter to the fuel pump, where the temperature was kept constant regardless of load. The oil was heated once more just before it entered the fuel injection valve, in order to lower its viscosity so that it would be readily atomized and conveyed into the combustion chamber, by the injection air.

Referring now to the diagram showing the heating system used (see p. 116) a water heater *A* was placed in the exhaust pipe of cylinder No. 2. This heater contained two heating coils so arranged that any desired water temperature could be obtained at all loads. This was accomplished by butterfly valves which could bypass the exhaust gases more or less as desired. Thermometers were attached at the inlet and outlet of the heating coils. The water was circulated by a pump, *B*, and distributed through the various heating coils located in the fuel-oil sump tank, *C*, fuel-oil filters, *D*, overhead service tank, *E*, and fuel pump *F*.

The heavy fuel oil was brought in barrels to the engine during the test and dumped into the sump tank, *C*. Here it was heated sufficiently so it could be pumped by the fuel oil circulating pump to the overhead tank, *E*. The latter pump is built integral with the engine and is part of its standard equipment. The temperature of the oil in the tank, *E*, was increased so it could flow by gravity through the twin fuel-oil filter, *D*, of which only one side was used. This filter, as stated above, also contained a heating coil and it was equipped with a thermometer to determine the fuel oil temperature. From the filter the oil ran by gravity to the fuel pump, *F*. Another thermometer was attached just in front of the fuel pump where the temperature was at all times kept approximately constant. From the fuel pump, the oil was discharged through a heating coil located in the exhaust port of the cylinder head, whence it passed through a check valve into the fuel valve.

It was gratifying to find that the surfaces of the various heating coils were in desired proportion and of proper size and that no alteration was necessary to obtain the desired result. Not only did the heating system for the fuel oil function satisfactorily, but also the engine proper. There seemed to be no difference whether light or heavy fuel oil was used, so far as the operation of the engine was concerned. The engine was thoroughly inspected at the end of the test, and the cylinder liners were found well lubricated and highly polished. The tops of all pistons were free of carbon and none of the piston rings were gummed up, and the cylinder heads and exhaust valves were in as good condition as found in Diesel engines when operated on light fuel oils with clear exhaust.

It may be mentioned that it was necessary, just before stopping the engine, to change the fuel from heavy to lighter oil. This was done to clean the fuel pump and pipes of heavy fuel oil and to dispel the exhaust gases of the heavy fuel oil from the exhaust pipes. If this is not done the moisture in the exhaust gases, after the engine has been stopped, will condense and unite with the sulphur dioxide contained in the exhaust gases, forming sulphuric acid, which would cause a heavy corrosion of the exhaust pipes.



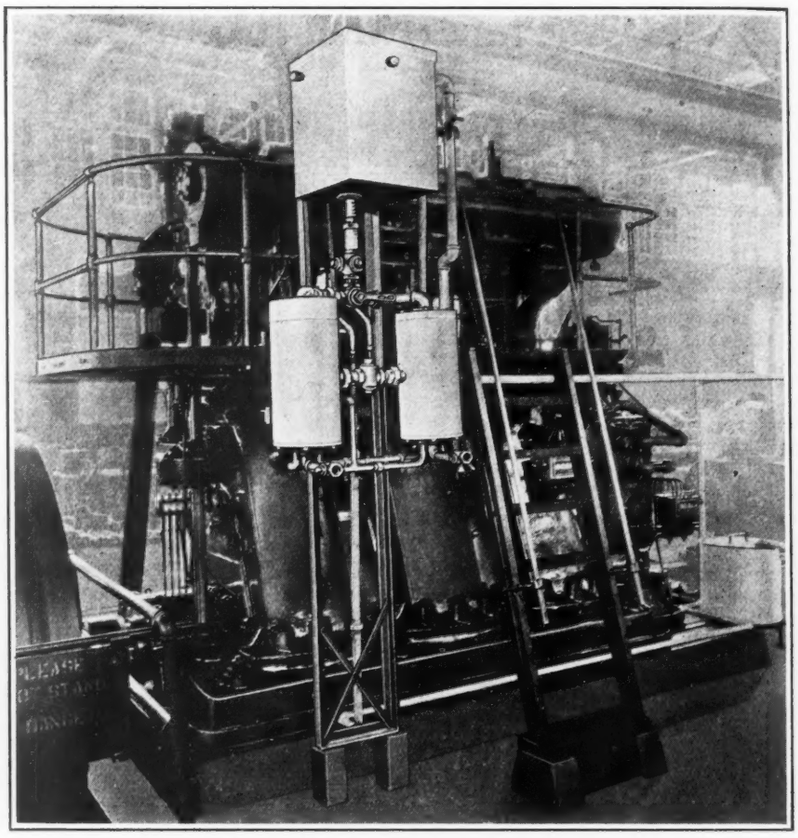
Front side of Diesel engine showing heating equipment

The engine was started with light oil from the overhead tank, *G*, passing through the filter, *D'*, into the fuel pump, while the heavy fuel was being heated. It took from one-half to three-quarters of an hour, depending on the temperature at the test stand, to heat the whole system, after which the fuel was changed from light to heavy fuel oil with which the test was conducted.

Though the engine could be easily and successfully operated under fluctuating loads down to no load, with perfectly clear exhaust, it should be mentioned that a continuous run without any load was not altogether satisfactory, after the temperature of the combustion chambers corresponded to no load. These conditions, however, were improved after the compression was temporarily raised from the normal (475 to 530 lb.). There was no difficulty in obtaining perfectly clear exhaust when the engine was operated with normal compression and when running at quarter load.

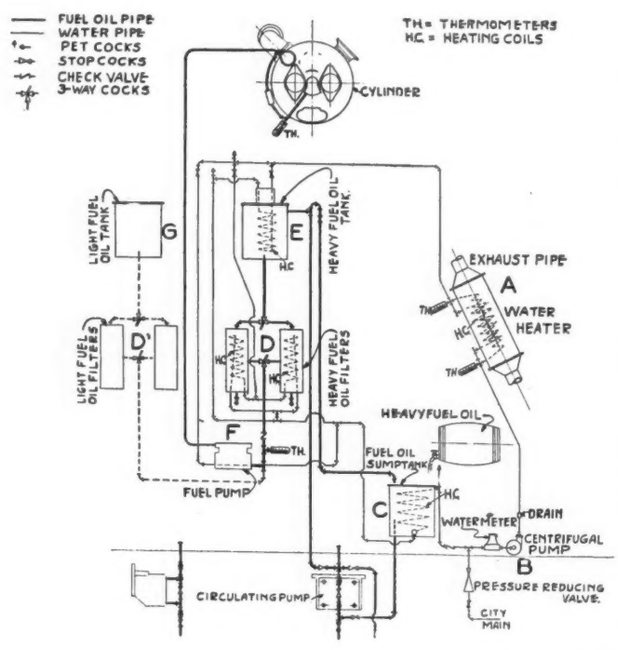
The halftones show photographs of the rear and front side of the engine with its heating equipment. The water heater, the fuel-oil tanks, twin filter, for the heavy fuel oil, the hot water and fuel-oil pipes, were painted white so as to distinguish them from the engine. The over-head tank and the twin filter for the heavy fuel oil can be plainly seen in the view on this page.

The splendid results obtained with the heavy fuel oil were to a great extent due to proper functioning of the fuel-oil heating system, the proper selection of the injection pressure, atomizer plates, atomizer nozzle, and some other refinements of the Fulton-Diesel. It may be stated that the atomizers of this make of Diesel follow, in general, conventional lines; that is, the fuel is discharged and evenly distributed on perforated atomizer plates and the injection air forces, rather than siphons, the fuel through said plates and nozzle into the combustion chamber.



Rear side of Diesel engine with heating equipment. Note the overhead tank and twin filter for the heavy fuel oil with which the tests were made

The tests referred to proved that smaller Diesel engines as well as large ones can burn heavy fuel oil successfully, even at fluctuating loads, provided they are properly designed and equipped with a suitable fuel-oil-heating system. It should not be inferred that all small engines built at present will handle heavy fuel oil. Unless the engine is built to burn heavy fuel oils successfully, and actually does so with perfectly clear exhaust, it is not advisable to use heavy fuel oil, as the savings would be more than counterbalanced by increased maintenance cost and frequent shutdowns that would result from the use of such fuel.



Piping plan for burning heavy fuel oil

New Starter for Squirrel-cage Induction Motors

A new design of manually operated, inclosed resistor starter can be used for starting squirrel-cage induction motors up to 20 hp., 550 volts, under light load. The resistance is proportioned to give an inrush current of 3½ times the normal full load motor current, permitting the motor to develop at least 50 per cent full-load torque at the time of starting.

The starter is made by the General Electric Co. and is of the safety type, completely inclosed with ventilated case, externally operated, and provides overload and undervoltage protection. It is furnished with a single-step resistor, equal parts of which are connected in each phase. The switching elements are of the contact finger type, strong and readily renewable.

Trade Catalogs

Fans. A folder issued by the American Blower Co., of Detroit, Mich., describes the use of fans for keeping workmen cool at forges and other places.

Hoists. Catalog No. 24 of the Llewellyn Iron Works, of Los Angeles, Calif., describes a large hoist recently built for a lumber company in California, for handling log cars over a 9,000 ft. incline with a total fall of 3,000 ft., with grades from 12 to 66%.

The Market Report

Daily Prices of Metals

July	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
10	12.125	42.875	43.375	7.00	6.70	5.80@5.85
11	12.15	43.50	44.00	7.00	6.70	5.825@5.85
12	12.15	43.75	44.25	7.00	6.70	5.825@5.85
14	12.15	44.50	45.00	7.00	6.70	5.825@5.85
15	12.15	44.625	45.125	7.00	6.70	5.85
16	12.125@12.25	45.75	46.25	7.00	6.70	5.85@5.875
Av.	12.152	44.167	44.667	7.00	6.70	5.842

*These prices correspond to the following quotations for copper delivered: July 10th, 12.375c.; July 11th to 15th, 12.40c.; July 16th, 12.375@12.50c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
10	61	62	65¼	220½	222½	33⅜	30½	31⅞	31⅝
11	60¾	61¾	65	222½	224⅛	32¾	30⅛	32	31⅝
14	60⅞	61⅞	64¾	226½	228½	32⅞	30¼	32⅛	31¾
15	60⅞	61⅞	64¾	226½	227¾	32¾	30¼	32¼	31¾
16	61	61⅞	65	231½	232¾	32⅞	30½	32⅛	31¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver		Gold London	July	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
10	4.34⅛	66⅞	34⅝	95s	14	4.37¾	67½	34⅝	94s 3d
11	4.35¼	67	34 9/16	94s 11d	15	4.36⅝	67¼	34⅝	94s 4d
12	4.36⅞	67¼	34⅝	.....	16	4.36¾	67¼	34⅝	94s 7d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half of a cent premium.

Metal Markets More Active with Higher Prices

New York, July 16, 1924 — Metal producers are more optimistic than for some weeks. Inquiry for all of the more important non-ferrous metals has been much better than a week ago, and consumers report that the demand for finished goods is improving in many lines. Prices have not advanced to any great extent, but slight increases are in evidence all along the line, and there is less of a desire to shade quotations to get business. The improvement in the local market cannot be said to have resulted from any advance in prices on the London Metal Exchange, for they have remained practically stationary with the exception of tin, but the improved condition of sterling exchange has made parity higher. Any improvement in sterling exchange is a very real factor in the domestic metal market, which is sure to profit further should the advance continue.

Copper in Much Better Demand

The general price level of copper for delivery in the Connecticut Valley and other near-by points has been 12⅝c. all week, though today only one or two sellers have been willing to make that quotation, and that for July shipment. Others are at 12⅛c. The sale made a week ago at 12¼c., delivered, seems to have been the last at that level. In the Middle West, 12⅛@12⅝c. has been paid, depending upon distance from the refineries. The volume of business has been larger than for some weeks, and an encouraging factor is seen in that some large corporations who use extreme care in their buying have been in the market. One particularly good order was placed yesterday. Brass and wire manufacturers report an improvement in orders, brass makers having a particularly good demand for tubes.

The foreign demand has also been good all week, with England, France, and Germany important buyers. Today, bids of 12.65@12.70c., c.i.f., were made, so that it is no wonder that producers here were not anxious to book domestic business under 12½c.

The copper statistics for June have so far been successfully concealed, but it is understood that they were not so unfavorable as feared and that some indication of a reduced production is at last in evidence.

Copper for forward delivery is somewhat stronger than is prompt. Most of the sales have been made for August-September.

Lead Still at 7c.

The official contract price for lead of the American Smelting & Refining Co. continues at 7c., New York. This price is also that generally quoted by all interests. Rumors of slight cuts in this price in the New York territory still persist, but we are convinced that little if any has been sold at 6.95 or 6.975c. Demand has not been so active as in the spring, but it is improved over the last few weeks, and producers have no fears for the immediate future. In the Middle West there has been a slight strengthening of prices, 6.70c. being the almost universal quotation for both St. Louis and Chicago, both from producers and dealers, till today when 6.75c. Chicago ruled. On Thursday a slight shading was in evidence in one sale which went at 6.675c., but nothing under 6.70 has since been reported. Foreign demand for lead has also been good, and the premium on spot in the London market continues excessive.

Galvanizers Again Buy Zinc

Galvanizers apparently came to life during the week, but most of the orders went to one producer, who did an exceptionally large business. Prices improved somewhat, and today prompt could not be obtained for less than 5.85c., with 5¾c. done for August or September shipment. There was little incentive for producers to sell at last week's level of 5.80c. so long as they could get around 5.90c. for export orders. A fair demand for high-grade zinc continues from brass makers, the price being unchanged at 7¾@8¼c., delivered in the East.

Tin Jumps Up Again

The moguls of the tin market in London successfully engineered another raise this week, marking the price up £4 on Monday and £5 today. With the improved tone of sterling exchange, this means better than 46c. for Straits tin here. American buying improved a little, but consumers generally seem content to remain aloof from the market. Arrivals of tin so far in July total 2,032 long tons according to the New York Metal Exchange.

Foreign Exchange Higher

Sterling advanced three or four cents above last week's quotations, and other exchanges are also somewhat higher. Closing cable quotations on Tuesday July 8 and 15 respectively were as follows: francs, 5.12 and 5.1625c.; lire, 4.275 and 4.305c.; and Canadian dollars, $\frac{1}{16}$ per cent discount on both dates.

Silver Steady

London quotation has held steady. New York prices have advanced with sterling. Market quiet at close, with tendency uncertain.

Mexican Silver Dollars—July 10th, 51⅜c.; 11th, 51½c.; 12th, 51¾c.; 14th, 51¾c.; 15th, 51⅜c.; 16th, 51⅜c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28@29c. per lb.; 98 per cent, 26½@27c. London, £125 per long ton.

Antimony—Per lb.:
Chinese brands, 8.25@8.35c.
W. C. C. brand, 10½c.
Cookson's "C" grade, 11½c.
Chinese needle, lump, nominal, 8½@9c.

Bismuth—$2.35@$2.40 per lb. London, 10s.

Cadmium—60c. per lb. London, 2s. 6d. Some German cadmium offered here recently for 56c.

Cobalt—2.50@$3 per lb. for spot.

Iridium—$260@$270 per oz.
Iridium alloyed with platinum, $280@$286.

Nickel—27c. per lb. for 99 per cent virgin metal. London, £135 long ton.

Osmiridium—Crude, $58.50 per oz.

Osmium—$95@$104 per oz.

Palladium—$78@$83 per oz. Crude, $60 per oz.

Platinum:
Refined, $118 per oz.
Crude, $113@$114 per oz.
Market steady.

Quicksilver—$73 per 75-lb. flask. San Francisco wires $71.65; London, £13.

Rhodium—$85@$90 per oz.

Ruthenium—$40@$45 per oz.

The prices of **Germanium Oxide, Magnesium, Molybdenum, Monel Metal, Radium, Selenium, Tellurium, Thallium, Tungsten and Zirconium** are unchanged from the prices given in the July 5 issue.

Metallic Ores

Chrome — $19@$22, depending upon grade and source. Nominal.

Manganese—42@46c. per long ton unit, seaport, c.i.f. Nominal.

Molybdenum—80c. per lb. of MoS_2 for 85 per cent concentrates. Nominal.

Tungsten Ore—Per unit, N. Y.:
High-grade wolframite, $9@$9.25.
High-grade scheelite, $9.25.
Ordinary grades, $8.50@$8.75. Nominal.

Iron Ore, Magnetite, Tantalum, and **Vanadium** are unchanged from July 5 quotations.

Zinc and Lead Ore Prices Firm

Joplin, Mo., July 12, 1924—Zinc blende, per ton, high, $41.65; basis, 60 per cent zinc, premium, $41@$40; Prime Western, $40@$39; fines and slimes, $39@$37; average settling price, all zinc ores, $38.28.

Lead, high, $85.60; basis 80 per cent lead, $80; average settling price, all grades of lead, $79.64 per ton.

Shipments for the week: Blende, 11,340; lead, 1,249 tons. Value, all ores the week, $533,660.

Mills that were closed down especially for the week of the Fourth resumed operation on Monday. Others were closed down for an indefinite period. Production is now around 12,000 tons per week, very little in excess of the shipment. Sellers are asking a living price for ore and will not sell unless that price is met. Where the zinc and lead occur in separate workings the latter is being produced, leaving the zinc a reserve in the ground.

Platteville, Wis., July 12, 1924—Blende, basis 60 per cent zinc, $41.50@$42.50 per ton. Lead, basis 80 per cent lead, $86 per ton. Shipments for the week: Blende, 710 tons; lead, none. Shipments for the year: Blende, 15,369; lead, 532 tons. Shipments for the week to separating plants, 1,306 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Beryl, Borax, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli and **Zircon** are unchanged from July 5 prices.

Mineral Products

Arsenious Oxide (white arsenic)—7⅜c. per lb. Demand fair.

Copper Sulphate—4.50c. per lb. for domestic in carload lots. Imported at marked concessions.

Potassium Sulphate, Sodium Sulphate, Sodium Nitrate and **Zinc Oxide** are unchanged from July 5 prices.

Ferro-Alloys

Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from the prices given in the July 5 issue.

Metal Products

Copper—Sheets, 19½c. base; wire, 14¾c.

Lead Sheets—Cut, 11c.; full, 10¾c. per lb.

Nickel Silver—18 per cent Grade A sheets, 25¾c.

Yellow Metal — Dimension sheets, 17¼c.; rods, 14¼c.

Zinc Sheets—Base price, $9.50 per 100 lb., f.o.b. plant.

Refractories

Firebrick — First quality, $40@$43 per M., Ohio, Kentucky, and Pennsylvania works; second quality, $33@$38.

Silica Brick—$36@$38 per M., Pennsylvania; $48, Alabama.

Bauxite Brick, Chrome Brick, Magnesite Brick, Magnesite Cement, and **Zirkite** are unchanged from July 5 prices.

Iron Trade Continues Dull

Pittsburgh, July 15, 1924—The finished-steel markets, considered as a whole and with practically no exceptions as to individual lines, have been noticeably more inactive in the first half of July than in the latter part of June, although at that time it looked as if the steel market had become as dull as it could be and that the next change would be an increase in demand through depletion of stocks.

June production was not as small as was commonly estimated. The month's ingot production, since reported, was 2,056,466 tons, representing a daily rate of 82,259 tons and an annual rate of 25,600,000 tons, or 47.4 per cent of estimated capacity. Production and shipment of finished steel was at about 55 per cent. July shipments will be nearer 40 per cent.

The Steel Corporation's unfilled tonnage decreased 365,584 tons in June, against 580,358 tons in May. There was a considerable decrease in shipments and a slight increase in bookings from May to June, probably accounted for in chief by several orders for line pipe.

In bars, shapes, and plates, mills are making a stronger effort this month to hold prices steady. The principal producers are holding strictly to 2.15c. on regular trade, with a concession of $1 a ton on large fabricated steel jobs and freight cars. Shading in sheets is more pronounced, 3.50c. being frequently done on black, against the leading interest's price of 3.65c. Merchant pipe and oil-country goods generally remain at prices of April, 1923, but there is doubt whether these prices can long hold, being out of line with commodities that have declined.

Pig Iron—The market has reverted to a state of extreme dullness, after the mild buying of June. Bessemer, $20.50; basic, $19; foundry, $19, f.o.b. Valley furnaces.

Connellsville Coke—Demand is very light. Furnace is quoted at $3. Foundry is off 25c., at $4.25@$4.75.

Company Reports

Park City Mining & Smelting Co.

Silver, Lead; Park City, Utah

A financial statement of the operations of the Park City Mining & Smelting Co. for 1923 follows:

Cash in bank Dec. 31, 1922			$548,221.71

Receipts

Ore sales			
Crude 26,820 tons @	$35.351	$948,115.39	
Lease 6,317 tons @	15.37	97,092.79	
Concentrates 13,562 tons @	41.46	562,431.79	
Zinc 10,720 tons @	19.444	208,446.00	
		$1,816,085.97	
Interest on loans, investments and deposits	$31,264.71		
Dividends Park Utah stock	4,500.00		
Sundry receipts	4,478.47	40,243.18	1,856,329.15
			$2,404,550.86

Expenditures

Mine account	$576,490.46		
Mill account	70,928.24		
Ore expense	89,197.27		
Prospecting and dead work	208,433.82		
Zinc plant	21,703.28		
General	121,430.14	1,088,183.21	
Net investments in securities	$598,991.97		
Dividend expense	211.63		
Dividends paid, No. 2, 3, 4, 5	459,900.00	1,059,103.60	2,147,286.81
Cash balance Dec. 31, 1923			$257,264.05
Secured loans		$21,928.07	
Bills receivable			
New Quincy Mining Co. note, principal	$30,325.60		
Interest to Jan. 1, 1924	10,695.39	$41,020.99	
Stocks and bonds			
U.S. Government securities, face value			$600,000
Park Utah Mining Co. stock, shares			7,500
Daly Mining Co. stock, shares			34,000
New Quincy Mining Co. stock, shares			50,000

Ore Statement for 1923

Dry Tons			
Crude ore sold	33,139	Lead concentrates sold	13,562
Ore concentrated	50,718	Zinc concentrates sold	10,720

Total Metallic Values for 1923

Gold, Oz.	Silver, Oz.	Lead, Lb.	Copper, Lb.	Zinc, Lb.
1,719.57	1,445,299	20,807,213	1,135,580	8,904,032

Tabular Financial Statement for January, February and March, 1924

Balance Jan. 1, 1924			$920,213.11
Receipts			
Ore sales			
Concentrates 6,606 tons @	$46.92	$309,976.14	
Crude 5,340 tons @	30.93	167,936.57	
Lease 842 tons @	15.36	12,938.45	
Zinc 2,580 tons @	17.27	44,557.40	
		$535,408.56	
Interest on deposits and bonds		7,328.59	
Dividend (Park Utah Mining Co. No. 10)		1,125.00	
Miscellaneous receipts		106.32	543,968.47
			$1,464,181.58
Expenditures		$302,406.00	
Dividend No. 6		131,400.00	433,806.00
			$1,030,375.58
Balances as of April 1, 1924			
Cash on hand		$217,426.52	
U.S. Securities—face value		750,000.00	
Loans and bill receivable		62,949.06	
			$1,030,375.58

Burma Corporation, Ltd.

Lead, Silver, Zinc; Burma

A report for the quarter ended March 31, 1924, of the Burma Corporation states that a total of 80,468 tons of ore was extracted, having an average assay value of 21.82 oz. of silver, 23.8 per cent lead and 15.03 per cent zinc. Respecting production, 71,450 tons of ore was milled, averaging 21.76 oz. of silver, 23.74 per cent lead and 15.01 per cent zinc. This included the re-treatment of 168 tons of accumulated mill tailing, averaging 22.78 oz. of silver, 18.57 per cent lead and 18.7 per cent zinc. Production was 13,922 tons of hard lead assaying 95.65 oz. of silver per ton. The refinery produced 11,979 tons of refined lead and 1,276,311 oz. of refined silver. In addition to the foregoing, 200 tons of antimonial lead was sold and shipped, and 346 tons copper matte produced and shipped from the treatment of 1,967 tons of copper ore and accumulated smelter byproducts.

Estimated Revenue and Expenditure

		Total
Estimated gross revenue	Rs.95,68,400	£637,893
Estimated operating expenditure	50,84,600	338,973
Estimated surplus over working expenditure	Rs.44,83,800	£298,920
Debenture interest	Rs.2,70,000	£18,000
Estimated income tax	5,60,300	37,353
Estimated depreciation on machinery and plant	6,23,200	41,547
Capital expenditure	8,67,700	57,846

The sterling figures shown are based on the rate of exchange—Rs.15 to the £.

St. John del Rey Mining Co.

Gold; Brazil

The annual return of gold and silver from the Morro Velho mine of St. John del Rey Mining Co. during the financial year ended March 1, 1924, states that 158,200 tons was crushed, producing 106,549.8 troy ounces of refined bullion, having a par value of £452,425.

Silver to the total value of £3,502 was also recovered. The proportion of mineral rejected was 2.27 per cent. Brazilian exchange for the company's drafts average 5.591d. per milreis.

The tonnage stamped was higher by 700 tons than that of the preceding year, but the bullion realized £23,247 less, taking gold at its par value. The decline in the yield of the mineral is explained as due partly to the crushing of comparatively low-grade ore obtained in the course of the explorations at Horizon "23" and to other causes which adversely affected the recovery.

There was a small reduction in the amount received as premium on the gold, but a considerable decline, amounting to £50,230, in working cost, compared with that of 1922-23, a result to which the continued fall in the rate of exchange contributed.

The profit for the year shows an increase of £16,076 over that of the preceding year, and amounts to £164,899, which, with the balance of £41,919 brought forward, makes a total of £206,818.

The labor question continues to cause anxiety. Special efforts have been made to obtain labor in Brazil and from other countries, but without much success. The provision of more houses with gardens seems to offer the best hope of attracting and retaining good men.

Considerable difficulty was encountered in locating the main lode at Horizon "23." This appears to have been due to the lode being further to the east than was anticipated. The latest advices state that the lode has been laid open for a distance of 771 ft. at this horizon, and that the assays indicate the mineral to be of good quality.

Tonopah Belmont Development Co.

Gold, Silver; Tonopah, Nev.

A condensed statement of the operations of the Tonopah Belmont Development Co. for the quarter ended March 31, 1924 follows:

Received and receivable for ore	$161,492.65
Mining, milling and administration expenses	125,030.06
Net earnings for three months	$6,462.59
Miscellaneous income	10,544.00
Total net income for three months ended March 31, 1924	$47,006.59

Available Resources, May 31, 1924

Due from smelter	$75,785.03
Due from others	133,738.63
Cash in banks	391,921.88
U.S. Treasury Notes	100,000.00
Liberty Bonds	50,031.25
	$751,476.79

The net earnings for the quarter ended March 31, 1924, of the Belmont Surf Inlet Mines, Ltd., of which his company owns 80 per cent, were $8,859.61.

Mining Stocks

Week Ended July 12, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb	...	...	*10	...	...
Anaconda	New York	30⅜	29⅞	30⅛	De.15, Ja.21, Q	0.75
Arcadian Consol.	Boston	1¼	1¼	1¼	...	...
Ariz. Com'l.	Boston	8⅝	8½	8⅝	Jy.19, Jy.31	0.50
Calaveras	N. Y. Curb	...	...	1½	...	...
Calumet & Arizona	Boston	44½	44	44	Jn. 6, Ju. 23 Q	0.50
Cal. & Hecla (New)	Boston	14¾	14⅜	14⅝	My. 31, Jn. 16	0.50
Canario Copper	N. Y. Curb	3⅜	3	3¼	...	...
Cerro de Pasco	New York	47⅜	46⅛	47	Ju. 17, Au. 1	1.00
Chile Copper	New York	28⅛	28⅛	28⅛	Jn.2, Jn.30, Q	0.62½
Chino	New York	18	18	18	Sept., 1920,	0.37½
Con. Coppermines	N. Y. Curb	2⅛	2⅛	2⅛	...	...
Copper Range	Boston	21⅛	21⅛	21⅛	May, 1923	1.00
Crystal Copper	Boston Curb	*58	*56	*58	...	...
Davis-Daly	Boston	*50	*50	*50	Mar., 1920	0.25
East Butte	Boston	4½	4	4	Dec., 1919	0.50
First National	Boston Curb	*32	*32	*32	Feb., 1919,	0.15
Franklin	Boston	†*45	...	...	...	...
Gadsden Copper	Boston Curb	*75	*70	*75	...	...
Granby Consol.	New York	14⅛	13⅞	13⅞	May, 1919	1.25
Greene-Cananea	New York	11⅛	11⅛	11⅛	Nov., 1920	0.50
Hancock	Boston	†*75	...	...	...	...
Howe Sound	N. Y. Curb	2	2	2	Ap.1, Ap.15, Q	0.05
Inspiration Consol.	New York	23⅜	22⅛	22⅝	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	*2⅛	*2⅛	*2⅛	May, 1923	0.15
Isle Royale	Boston	13	12⅜	12⅝	Se. 1, Se. 15,	0.50
Jerome Verde Dev.	N. Y. Curb	...	...	*90	...	...
Jib Consol.	N. Y. Curb	*95	*60	*85	...	...
Kennecott	New York	40¾	39⅝	40⅛	Jn.6, Jy. 1, Q	0.75
Keweenaw	Boston	†*60	...	...	...	...
Lake Copper	Boston	1⅛	1⅛	1⅛	...	...
Magma Copper	New York	28	27½	27½	Jan., 1919	0.50
Mason Valley	N. Y. Curb	...	...	1⅝	...	...
Mass Consolidated	Boston	*75	*75	*75	Nov., 1917	1.00
Miami Copper	New York	20⅜	20⅛	20⅛	Au 1. Au.15, Q	0.50
Mohawk	Boston	26	25	25½	Se. 22, Oc. 13,	1.00
Mother Lode Coa.	New York	7	6⅛	7	Jn.13, Jn.30	0.37½
Nevada Consol.	New York	13	13	13	Sept., 1920,	0.25
New Cornelia	Boston	18⅛	17⅞	18	My.9, My.26,	0.25
New Dominion	N. Y. Curb	...	...	2⅛	...	...
North Butte	Boston	4	3 3/16	3 5/16	Oct., 1918,	0.25
Ohio Copper	N. Y. Curb	1 1/16	*96	*98	...	...
Old Dominion	Boston	17	17	17	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†106	†101	...	Jn.21, Jy.2 Q	1.00
Quincy	Boston	17	16	17	Mar., 1920	1.00
Ray Consolidated	New York	11	10⅞	11	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	*13	*10	*10	...	...
St. Mary's Min. Ld.	Boston	27⅛	27⅛	27⅛	Ap.22, My.20	3.00
Seneca Copper	New York	3	3	3	...	...
Shannon	Boston	*55	*55	*55	Nov., 1917	0.25
Shattuck Arizona	New York	5	4⅞	4⅞	Jan., 1920	0.25
Superior & Boston	Boston	†*55	...	...	...	...
Tenn. C. & C. cfs.	New York	7⅛	6⅞	7	De.31, Ja.15, Q	0.25
Utah Copper	New York	70⅞	70⅛	70⅞	Jn.13, Jn.30,	1.00
Utah Metal & T.	Boston	*30	*27	*27	Dec., 1917	0.30
Victoria	Boston	†*60	...	...	...	...
Walker Mining	N. Y. Curb	...	...	3	...	...
Winona	Boston	*20	*20	*20	...	...
NICKEL-COPPER						
Internat. Nickel	New York	17⅛	16⅞	17	Mar., 1919	0.50
Internat. Nickel pfd.	New York	89	84½	89	Jy.17, Au.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	3⅛	2⅛	3⅛	...	...
National Lead	New York	146	141	144½	Jn.13, Jn.30, Q	2.00
National Lead pfd.	New York	113	113	113	My. 23, Ju. 14, Q	1.75
St. Joseph Lead	New York	27⅛	26½	27⅛	Se. 9, Se.20	0.50
ZINC						
Am. Z. L. & S.	New York	7⅛	7⅛	7⅛	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	26½	26½	26½	Nov., 1920	1.50
Butte C. & Z.	New York	4½	4½	4½	Ma., 1923	0.50
Butte & Superior	New York	15¼	14¼	14¼	Je.15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	3⅛	3	3	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	143⅞	143⅛	143⅞	May 10, 1924	2.00
United Zinc	N. Y. Curb	...	...	*25	...	...
Yellow Pine	Los Angeles	65	63	63	June, 1924	0.04
SILVER						
Alvarado	N. Y. Curb	1	1	1	...	...
Beaver Consol.	Toronto	*15	*14	*14½	May, 1920	0.03
Castle-Trethewey	Toronto	*67½	*66	*66½	...	...
Coniagas	Toronto	1.80	1.45	1.90	Ap.20, My.1	0.02½
Crown Reserve	Toronto	*51	*50½	*50½	Jan., 1917	0.05
Keeley	Toronto	2.22	2.21	2.21	...	...
Kerr Lake	N. Y. Curb	1⅛	1⅛	1⅛	Ap.1, Ap.15, Q	0.12
La Rose	Toronto	*10	*10	*10	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.37	1.35	1.35	...	...
McKinley-Dar.-Sav.	Toronto	*11	*10¼	*10¾	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.56	2.40	2.45	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6⅛	6	6	Jn.30, Jy.21, Q	0.15
Ontario Silver	New York	5⅜	5⅛	5⅛	Jan., 1919	0.50
Temiskaming	Toronto	21	20	20	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	⅛	⅛	⅛	...	...
Alaska Juneau	New York	1¼	1⅛	1⅛	...	...
Argonaut	Toronto	*43	*39	*41	...	...
Carson Hill	Boston	1	1	1	...	...
Cresson Consol. G	N. Y. Curb	3 1/16	3⅛	3 1/16	Jn.30, Jy.10, Q	0.10
Dome Mines	New York	16⅛	15¾	16¼	Jn.26, Jy.21, Q	0.50
Golden Cycle	Colo. Springs	...	...	1.27	My.31, Jn.10 Q	0.03
Hollinger Consol.	Toronto	13.55	13.15	13.35	Jn.26, Jy.14, M	0.05
Homestake Mining	New York	42	41	42	Jn.20, Jy.25,	0.50
Kirkland Lake	Toronto	*18¾	*16¾	*17⅞	...	...
Lake Shore	Toronto	3.76	3.70	3.75	My.2, My.15	0.02
McIntyre-Porcupine	New York	16	15⅞	16	Au. 1, Se. 1,	0.25
Newray	Toronto	*22	*21½	*21½	...	...
Portland	Colo. Springs	...	...	51	Oct., 1920	0.01
Teck-Hughes	Toronto	1.11	1.10	1.10	...	...
Tom Reed	Los Angeles	35¼	34	...	Dec., '1919	0.02
Tough-Oakes	Toronto	*57	*53	*56	...	...
United Eastern	N. Y. Curb	...	...	*50	Ap 10, Ap.28, Q	0.10
Vipond Cons.	Toronto	1.02	*98½	*99½	...	...
Wright-Hargreaves	Toronto	3.40	3.35	3.35	Jn.16, Jy. 1, Q	0.02½
GOLD AND SILVER						
Black Oak	N. Y. Curb	*85	*83	*85	...	...
Con. Cortez	N. Y. Curb	*18	*13	*15	...	...
Con. Virginia	San Francisco	3½	3½	3½	...	...
Continental Mines	N. Y. Curb	2¼	2⅛	2⅛	...	...
Dolores Esperanza	N. Y. Curb	...	...	*50	Jy. 1, Jy. 10 Q	0.05
Premier Gold	N. Y. Curb	2	1⅞	1⅞	Jn.19, Jy.2	0.08
Tonopah Belmont	N. Y. Curb	*54	*50	*50	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb	...	...	*24	Se.22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	2 5/16	2⅛	2⅛	Jn 10, Jy. 1	0.05
Tonopah Mining	N. Y. Curb	1⅝	1⅜	1 7/16	Ap. 6, Ap. 21	0.07½
Unity Gold	N. Y. Curb	1	*60	1	...	...
West End Consol.	N. Y. Curb	*31	*31	*31	Mar., 1923	0.05
Yukon Gold	N. Y. Curb			*50	June, 1918	0.02
SILVER-LEAD						
Ahumada	Boston Curb	5⅜	5⅛	5⅛	Jn.16, Jy. 2, X	0.15
Bingham Mines	Boston	16	16	16	Sept, 1919	0.25
Cardiff M. & M.	Salt Lake	...	...	*74	Dec., 1920	0.15
Chief Consol.	Boston Curb	3	2½	2¾	Ap 19, My.1, Q	0.10
Columbus Rexall	Salt Lake	18	17	17	Aug., 1922	0.03
Consol. M. & S.	Montreal	39	38	38	Jn.30, Jy.15	0.75
Daly Mining	Salt Lake	...	...	205	July, 1920	0.10
Erupcion	Boston Curb	2⅛	2⅛	2⅛	Jn. 16, Jy.2, X	0.15
Federal M. & S.	New York	...	...	9	Jan., 1909	1.50
Federal M. & S. pfd.	New York	48	44	44½	My.26, Jn.15, Q.	1.75
Florence Silver	Spokane	9⅞	8⅞	9	Apr., 1919, QX	0.01
Hecla Mining	N. Y. Curb	8¼	8⅛	8⅛	My.15, Jn.15,	0.25
Iron Blossom Con.	N. Y. Curb	...	...	*20	Oct., 1923	0.02
Marsh Mines	N. Y. Curb	...	...	*5	June, 1921	0.02½
Park City	Salt Lake	...	...	3.25	Jn.14, Jy.1,	0.15
Park Utah	N. Y. Curb	...	...	3⅛	Mc.15, Ap.1	0.15
Prince Consol.	Salt Lake	...	...	*8	Nov., 1917	0.02
Silver King	N. Y. Curb	...	...	*50	Jn.20, Jy.1, Q	0.15
Silversmith	Spokane	*33½	*31	*32½	Jy.1, Jy.10,	0.01
Tamarack-Custer	Spokane	1.52	1.48	1.48	Jn 25, Jn.30,	0.02
Tintic Standard	Salt Lake	4.45	4.40	4.45	Jy.28, '24, X	0.25
Utah-Apex	Boston	2⅛	2⅛	2⅛	June, 1923,	0.50
IRON						
Bethlehem Steel	New York	47	46	46½	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	...	...	1/16	...	...
Char. Iron pfd.	Detroit	¾	*70	...	...	...
Colorado Fuel & Iron	New York	49	46	47⅜	My.10, My.26	Q 2.00
Col. Fuel & Iron pfd.	New York	...	...	102	Feb., 1925	2.00
Gt. North'n Iron Ore	New York	27¼	27⅛	27⅛	De.10, De.27	2.00
Inland Steel	N. Y. Curb	...	...	46	My.15, Jn.1 Q	0.62½
Mesabi Iron	N. Y. Curb	...	...	2⅛	...	...
Replogle Steel	New York	12	10½	11½	...	...
Republic I. & S.	New York	48⅛	46⅛	47	May, 1921	1.50
Republic I. & S. pfd.	New York	86	86	86	Jn.14, Jy.1, Q	1.75
Sloss-Sheffield S.&I.	New York	60½	59⅛	59⅛	Jn.6, Jn.20, Q	1.50
Sloss-Shef. S.&I.pfd.	New York	83	83	83	Jn.18, Jy.2, Q	1.75
U. S. Steel	New York	101½	99⅜	101	Jn.1, Jn.28 QX	1.75
U. S. Steel pfd.	New York	122⅜	122	122⅜	My.6, My.29, Q	1.75
Virginia I. C. & C.	New York	...	...	36½	De.15, Ja. 2	1.50
Virginia I.C.&C.pfd.	New York	...	...	71	Jn.17, Jy.1	2.50
VANADIUM						
Vanadium Corp.	New York	22¾	21⅞	22½	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	...	...	*24	...	...
ASBESTOS						
Asbestos Corp.	Montreal	...	...	24	Se.29, Oc.15 Q	1.00
Asbestos Corp. pfd.	Montreal	60	60	60	Jy.1, Jy.16, Q	1.50
SULPHUR						
Freeport Texas	New York	9⅞	8½	9½	Nov., 1919,	1.00
Texas Gulf	New York	70¾	65¼	69¾	My.31, Jn.14 QX	1.75
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅜	3⅛	3⅛	...	...
MINING, SMELTING AND REFINING						
Amer. Metal	New York	42½	42	42½	My.20, Jn.1, Q	0.75
Amer. Metal pfd.	New York	112	112	112	My.20, Jn.1, Q	1.75
Amer. Sm. & Ref.	New York	67	65	65½	Jy.11, Au.1, Q	1.25
Amer.Sm.&Ref.pfd.	New York	102½	100¾	102½	Au. 8, Se. 1,	1.75
U. S. Sm. R. & M.	New York	22¾	22	22⅛	Jan., 1921,	3.50
U.S. Sm. R.&M.pfd.	New York	40½	40¼	40½	Jy.7, Jy.15 Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Colorado Springs, Colorado Springs Stock Exchange.